DOCUMENT RESUME

ED 398 440 CE 072 331

AUTHOR Marr, Beth; And Others
TITLE Numeracy on the Line. Language Based Numeracy Activities for Adults.
INSTITUTION National Automotive Industry Training Board, Doncaster (Australia).
SPONS AGENCY Australian Dept. of Employment, Education and Training, Canberra.
REPORT NO ISBN-0-646-16602-6
PUB DATE May 94
NOTE 259p.
PUB TYPE Guides - Classroom Use - Teaching Guides (For Teacher) (052)

EDRS PRICE MF01/PC11 Plus Postage.
DESCRIPTORS Adult Basic Education; *Adult Literacy; Arithmetic; Calculators; Classroom Techniques; Decima' Fractions; Foreign Countries; Graphs; *Language Experience Approach; Learning Activities; *Literacy Education; Number Concepts; *Numeracy; Percentage; *Workplace Literacy
IDENTIFIERS *Australia; *Automobile Industry

ABSTRACT

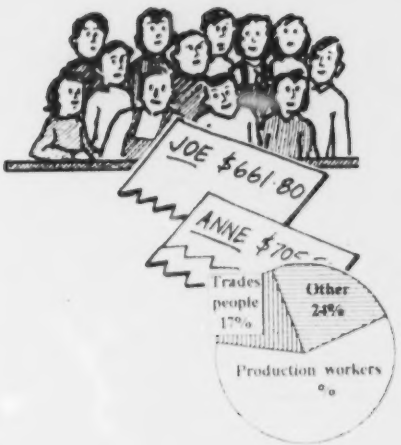
This document, which was developed to meet the needs of trainers and workers in Australia's automotive industry for learning activities designed to boost auto workers' numeracy skills, contains a total of 33 learning activities organized into 8 sections. The topics covered in the individual sections are as follows: calculators (key words and calculators, further practice); decimals (dials, gauges, and scales; decimal points; using sensible numbers; the first decimal place); percentages in daily life (familiar percentages, using calculators); percentages at work (lots of hundreds, faulty parts); charts and graphs (understanding charts, pumping petrol, types of charts, pie charts, plots); where to start solving a problem (ordering operations, using brackets, helpful rules); and what averages mean (using averaging to make predictions, distortion of averages, averages and ranges in workplace charts). Included in each section are the following: trainer's notes detailing procedures for introducing and using the different activities; activity sheets designed to introduce concepts and skills to groups using interactive, hands-on group discussion activities; practice sheets; and answers to all problems. Contains an annotated bibliography of 3 Australian resource organizations and 33 print resources concerned with adult literacy and numeracy. (MN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

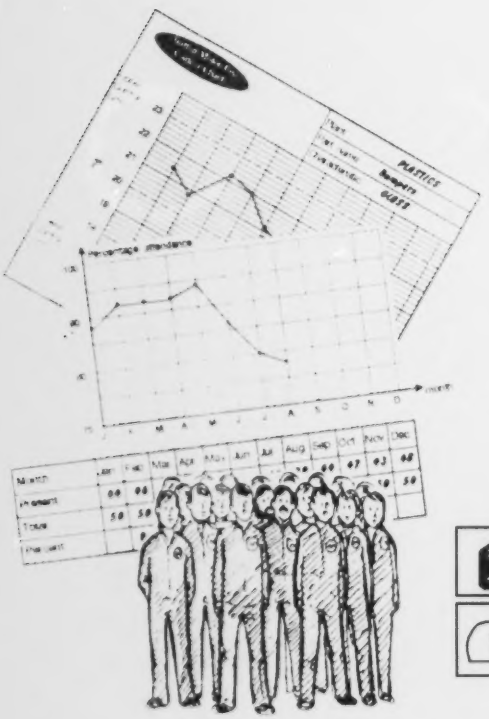
NUMERACY ON THE LINE

ED 398 440

Language Based Numeracy Activities for Adults



Written by:
Beth Marr
Chris Anderson
& Dave Tout



U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☐ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

J. Kindler

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

NATIONAL AUTOMOTIVE LANGUAGE & LITERACY COORDINATION UNIT

Published by the National Automotive Industry Training Board

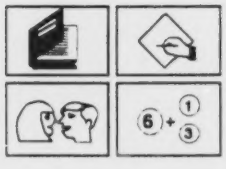
CE 072 331

BEST COPY AVAILABLE

NUMERACY ON THE LINE

Language Based Numeracy Activities for Adults

Written by:
Beth Marr
Chris Anderson
& Dave Tout



NATIONAL AUTOMOTIVE
LANGUAGE & LITERACY
COORDINATION UNIT

Published by the National Automotive Industry Training Board

Numeracy on the Line -
Language Based Numeracy Activities for Adults

First published May 1994 by the National Automotive Industry Training Board (NAITB) with funding from the Department of Employment, Education and Training (DEET)

Copyright: DEET, 1994

Limited Reproduction Permission
The Publisher hereby grants permission for trainers/teachers to reproduce copies of Activity Sheets and Practice Sheets for use with trainees/students. Any further duplication will require the permission of the Publisher and the authors on behalf of DEET.

National Library of Australia: **ISBN** 0 646 16602 6

Authors: Beth Marr, Dave Tout, Chris Anderson, National Automotive Language and Literacy Coordination Unit (NALLCU)

Desktop Publishing: Skill Ed P/L

Word Processing: Helen Kalcovski

Produced and Distributed by:
NAITB
Level 2, 651 Doncaster Road
Doncaster VIC 3108
Telephone (03) 848-8300
Facsimile (03) 848-8934

Acknowledgements

The development of this resource has been made possible by the support of NALLCU, the National Automotive Language and Literacy Coordination Unit, and NAITB, the National Automotive Industry Training Board. The funding has come through the Workplace English Language and Literacy Program of the Department of Employment, Education and Training in Canberra.

There are a number of individuals who have helped and encouraged the development of ***Numeracy on the Line***. They include Helen Kalcovski and Robin Sefton from NALLCU and many trainers from the Ford Motor Company, and our thanks go to them. In addition there are the many people with whom these activities were trialed - the workers from a number of Automotive plants around Victoria, students in our TAFE Colleges and participants at a number of Victorian Staff Development activities for literacy and numeracy tutors and teachers. Their enjoyment, interest, involvement, and feedback, has kept us working to improve and to finish this resource.

We have enjoyed the challenge, and the teamwork involved in producing **Numeracy on the Line**, and hope you find it a useful and stimulating resource.

Beth Marr
Chris Anderson
Dave Tout

Introduction

This resource has been prepared in response to the needs of trainers and workers in the automotive industry. However, most of the activities address issues and skills applicable to any modern workplace, and are general enough to be of value to most workers. Examples in practice sheets can be used as they are or adapted easily to suit alternative work situations and products. **Numeracy on the Line** should therefore be readily useable in a wide range of workplaces. It should also be applicable in general literacy, numeracy or basic education classes, and because of the focus on language, the materials are also highly relevant for use in language classrooms.

It is envisaged that the activities in this resource could be used flexibly: as the basis of a separate numeracy course; combined with other language and literacy activities in adult basic education; or interspersed as stimulus and practice material within existing industry training programs.

This resource is addressed to an audience of trainers coming from a workplace background rather than an educational perspective. It therefore attempts to use straightforward language with a minimum of educational jargon and uses the terminology of the workplace: e.g. trainers and trainees instead of the more usual teacher and student.

The topics and skills selected have come from the immediate demands identified by trainers and by analysis of the relevant certificate programs. They do not therefore claim to be a comprehensive, nor sequential set of maths teaching materials. Reference to other resources covering basic arithmetic skills are given at the end of the book.

Because many of the trainers and teachers using this resource may be lacking confidence in their own mathematical backgrounds every care has been taken to provide clear explanations of the mathematics within the **Trainers' Notes**.

Numeracy on the Line also contains many notes on the educational rationale behind the activities and strategies used. Such notes are interspersed into the **Trainers' Notes** as well as being spelt out in the **Background** notes at the beginning of each section. Hopefully these will be useful not only to industry trainers but also to teachers coming from different teaching backgrounds and maths teachers more accustomed to traditional methods of teaching.

The approach taken in **Numeracy on the Line** is that adult students should be active participants in the learning process: that all learning activities and experiences should begin by acknowledging the learner's past experience and knowledge and providing maximum opportunity for them to explain their ideas to each other in pairs, small groups or larger group discussions. The materials have therefore been written

to be interactive and practical with many hands-on activities, and small group, cooperative work. These activities are supplemented with **Practice Sheets** for individual reinforcement and home study.

The major role that language plays in the learning of mathematics is also emphasised. With most of the trainees being from a non-English speaking background, often the problems they face are the result of not understanding the language of the maths involved and not being able to communicate the maths concepts to other workers. The materials therefore deliberately focus on the language of mathematics and encourage mathematical talk. Many of the activities, in fact, are designed specifically to provide opportunities for the learners to speak, listen and interpret the English vocabulary associated with numbers, mathematical operations and graphs.

For pragmatic reasons, the sections in **Numeracy on the Line** have been arranged to focus on particular groups of skills even though we recognise that they are continually interlinking and there is no predetermined order in which they should be tackled. In fact, we recommend that users of this resource select activities in an order to suit the needs, strengths and weaknesses of their students rather than following the sections in the order in which they are presented.

In the final section on **What averages mean** we have brought many of the skills together to model realistic whole work tasks. Centred around simulated workplace graphs and control charts, these tasks combine the skills of plotting graphs, interpreting and rounding off decimal numbers, using calculators and working out averages and ranges.

NAITB, Marr, Anderson, & Tout, 1994

What's in it?

Numeracy on the line is made up of 8 sections:

- Calculators - a tool to use
- Decimals - what's the point?
- Decimals - further places
- Percentages of your life
- Percentages at work
- Charts and graphs - reading for meaning
- Where do we start?
- What averages mean

Each section is made up of:

Trainers' Notes

The Trainers' notes give detailed advice on how to introduce and use the different sections. Each section begins with brief statements of purpose and background to the methodology, as well as instructions for what to prepare. There is also a flowchart of the content of the section.

Following this introduction to the section are detailed Trainers' Notes, which are provided for teachers and trainers using the material for the first time and who may not be confident on how to start.

Activity Sheets

Activity Sheets are designed for use within a group, to introduce concepts and skills through interactive, hands-on, small group or discussion activities. We believe this approach is essential for effective learning.

In most cases the opening activity is designed to assist the trainer gauge the knowledge and understanding of the group members. The information obtained should then indicate what further activities and practice areas are needed. Many of these activities require preparation in advance by the trainer/teacher. This is detailed at the beginning of the section.

Practice Sheets

These sheets are designed to reinforce and practise skills developed through the activities. They can be used either in the group situation or as individual home practice.

Note: Copies of the Activity Sheets and the Practice Sheets may be made for trainees or students.

NAITB, Marr, Anderson, & Tout, 1994

Answers

Where appropriate answers are supplied at the end of each section. For ease of reading many of these are reproductions of the actual work sheets with answers filled in.

Where else to go

This final, 9th section gives reference to other suitable publications and materials and particular worksheets, suitable for practising basic skills.

Order of the sections

The order in which the eight sections are presented are to some extent arbitrary, and do not need to be necessarily used in that order. Ideally materials from more than one section could be used in parallel, for example, graph interpretation interspersed with number skills development and the use of a calculator. We feel though that the most appropriate starting points would be either **Calculators - a tool to use** followed by the decimal sections, or **Where do we start?**. **Where do we start?** - which covers the order of operations - may be a logical beginning for calculator use with those trainees who have confidence with numbers and prior experience in using calculators. Trainees having little experience with a calculator may be better off to tackle **Calculators - a tool to use** first.

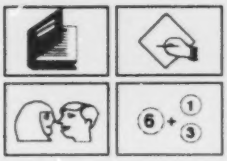
NAITB, Marr, Anderson, & Tout, 1994

Contents

Introduction
Calculators - a tool to use
Key words and calculators
Listen hear
Further practice
Decimals - what's the point?
Dials, gauges and scales
Decimals - what's the point
Using sensible numbers
The first decimal place
Decimals - further places
The second decimal place
The next decimal place
All three together
Percentages of your life
Familiar percentages
What do percentages look like?
Focus on four percent
Using the calculator
Percentages at work
Percentages of what?
Lots of hundreds
Faulty parts
Using calculators
Charts and graphs - reading for meaning
Understanding charts
Pumping petrol
The type of chart
Understanding pie charts
Understanding the plot
Where do we start?
Ordering operations
Using brackets
More complications - "of"
The BODMAS rule
The helpful M+ button
What averages mean
Acting it out
Using averages to make predictions
Practising and predicting averages
Distortion of averages
Averages and ranges in workplace charts
Where else to go

NAITB, Marr, Anderson, & Tout, 1994

Calculators - a tool to use



NATIONAL AUTOMOTIVE
LANGUAGE & LITERACY
COORDINATION UNIT

Calculators - a tool to use

Purpose

The activities in this section are designed to build confidence in the use of calculators for simple computation. They are particularly aimed at people who have not learned mathematics in English or not used calculators before.

Often, when trying to learn about workplace calculations, people are unable to follow instructions given to them because they do not understand the words spoken.

Words to do with arithmetic such as add, multiply, subtract, divide are not often used in ordinary conversation. As a result many people have not acquired this vocabulary and are confused in mathematical learning situations. They cannot hear the words "divide by" and immediately find the correct calculator button. If they are unfamiliar with a calculator, as well as the related language, they tend to become anxious and subsequently do not learn about the calculator nor the particular process such as finding an average or a range.

These activities promote discussion of the arithmetic words, practice at hearing and speaking them and relating them to the appropriate calculator keys.

NAITB, Marr, Anderson & Tout, 1994

Background

The attitude of individuals towards calculators varies enormously. Some people feel uncomfortable using them, or some are reluctant to use them at all. On the other hand many people see calculators as a panacea to all their problems with mathematics, whilst yet others see their use as cheating.

Calculators offer a speedy way of doing calculations and as such are a very valuable tool that should be used. However, they in themselves do not teach understanding. As well calculators can vary from calculator to calculator in the way they operate. We believe it is important that trainees become both competent and confident in their use of calculators.

What to prepare

For each trainee you will need to make:

- a photocopy of the following sheets
  - ❑ ***Key words***
  - ❑ ***Using your calculator***
  - ❑ ***Key words summary sheet***
  - ❑ ***Calculator symbols***
  - ❑ ***Listen and match***
  - ❑ ***Pressing work***
  - ❑ ***At home with calculators***
  - ❑ ***Calculators at work***

For convenience you may need to make transparencies of:

- ❑ ***Key words***
- ❑ ***Using your calculator***
- ❑ ***Listen and match***
- ❑ ***Listen and match - Trainer's Sheet***

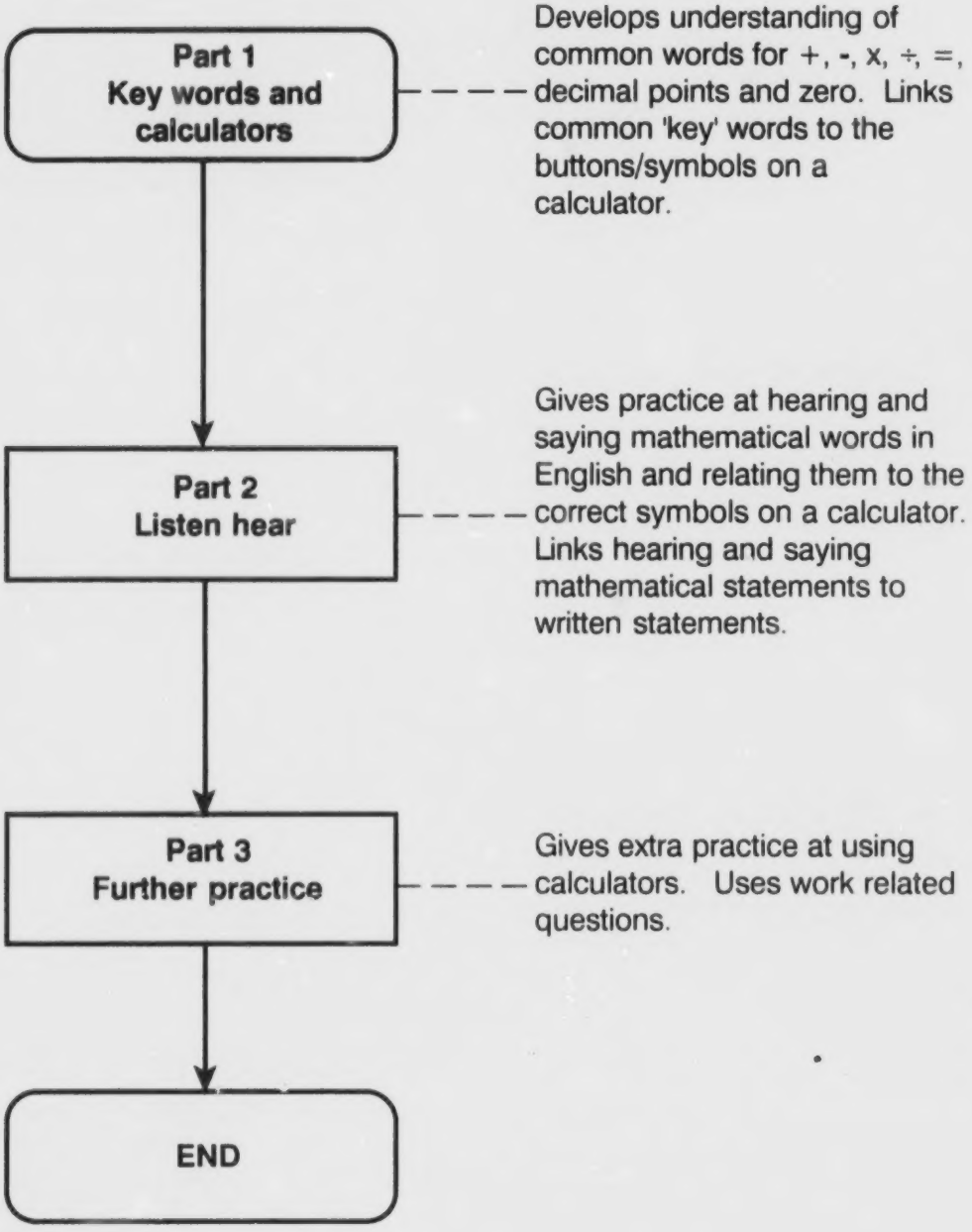
For each group of trainees have two labelled envelopes or plastic bags containing:

- ***Key word cards***
- ***Hear it right!***

Photocopy pages 13, 16 and 17 onto cardboard, two different colors if possible then cut these into separate cards.

NAITB, Marr, Anderson & Tout, 1994

Outline of section


Part 1
Key words and calculators
Develops understanding of common words for +, -, x, ÷, =, decimal points and zero. Links common 'key' words to the buttons/symbols on a calculator.
Part 2
Listen hear
Gives practice at hearing and saying mathematical words in English and relating them to the correct symbols on a calculator. Links hearing and saying mathematical statements to written statements.
Part 3
Further practice
Gives extra practice at using calculators. Uses work related questions.
END

NAITB, Marr, Anderson & Tout, 1994

Part 1: Key words and calculators

Activity - Key words

Put calculators on tables before the class begins.

Hand out Activity Sheet ***Key words*** and get trainees to look at the pictures, work out answers however they feel most comfortable, (with or without calculators) and to write their answers on the activity sheet beside the pictures.

The first part of this activity gives trainees a chance to show that they can instinctively do simple arithmetical calculations and to relate the operations they do to words and symbols used in English.

Presentation

Using a transparency of this Activity Sheet and projecting the overhead projector onto a whiteboard is very effective for the discussion to follow. Otherwise draw four sections on the board. Begin with the top left of the sheet.

Possible questions to ask:

- What answer did you get for this?
- What did you do?
- What language did you think in?
- What were the words that you used in your first language?

To begin this, as you discuss some of the words they were 'thinking', ask for volunteers to write their own language word for this process on the board.

To validate their knowledge from their past, it is important to acknowledge words from trainees' first language and give them equal status during this discussion. Also to have them written on trainees' own record sheets.

Do not push this too much if people are unwilling. Some will have forgotten the words because they have not used them for a long time, others may not have learned to write in their own first language. However, there are likely to be some people keen to contribute. Where possible, trainees should write their own language word.

Spend some time on discussion and comparison of words from all languages before going on.

NAITB, Marr, Anderson & Tout, 1994

Possible questions:

Now point to the empty calculator button in this section and ask:

- What is the sign, symbol, or shorthand that will go on this calculator button?
- What sign or shorthand do we use instead of these words?
- How do you know which button to press on the calculator?

People may not initially understand the word 'symbol'. However, it is an important mathematical word to spend some time discussing.

Go through the other sections of the activity sheet.

For each section, the class should:

- agree on the arithmetic answer
- briefly discuss some words
- agree on the symbol to place in the empty calculator key.

Trainees could sit in language groupings and decide themselves which words of their first language to put on their sheets.

Switch off the projector. Hand out envelopes of cut up symbols and words (one to each pair of trainees) - ***Key word cards***.

Each pair should together arrange these on **one** of their sheets, placing the words and symbol cards in the correct sections.

After five minutes discuss their results and see if all agree on which English words and symbols go together.

Make sure they have heard you say the correct pronunciation and encourage all trainees to say the words aloud.

Give out the ***Key words summary sheet*** for trainees to take home - (advise them to pin it up somewhere where they will see it often.) Ask them also to write any other key words they had written before - especially those in their own language.

NAITB, Marr, Anderson & Tout, 1994

Activity

Hand out Activity Sheet ***Using your calculator*** (same illustrations but now more complex prices to ensure calculators are useful).

Ask trainees to calculate the answers, using their calculators this time, and write them down beside the picture again. Allow enough time for everyone to have a go at this - encourage trainees to help one another if the calculators are new to them.

Discussion

Begin with addition first. Again a transparency of this activity sheet projected on the board is useful. Ask for and compare trainees' answers. On the board (under the illustrations) write down the calculation as it would appear on paper.

59.95 + 32.49 + 19.60 = ?

Ask a few people to have a go at reading it aloud in English with particular focus on the words for plus, and saying the numbers correctly. (At this stage money expressions such as fifty-nine ninety-five are acceptable.)

Discussion - Introducing [.] [=] and [0]

Two further symbols which need discussion appear in the first problem. When you come to the = sign, discuss alternative English words used, particularly 'equals' , 'is' and 'makes' and those in other languages if time permits.

Also in this problem , the answer, 112.04 contains a 'zero' or '0' - both ways of saying this should be mentioned. Make sure trainees see that it cannot be left out. Discuss different values of $112.04 and $112.4 (forty cents) if they do.

Secondly discuss the subtraction calculation because this leads to discussion of the decimal point outside of a money situation.

Again write out the calculation (or ask someone else to volunteer).

193 - 148.5 = ?

Encourage several people to read it aloud with particular focus on saying "one hundred and forty-eight **point** five" as well as the words "take away", "minus" or "subtract".

Discuss any other words used for the decimal point in English or other languages.

Also discuss other symbols which some people use eg. ',' Acknowledge that it is not wrong, but that to be understood here in English, we need to use '.' - pronounced point.

Locate the point on the calculator and get the class to practise two or three calculations that you read aloud.

eg. 23.2 - 15.6 *Answer 7.6*
100 - 89.7 *Answer 10.3*
19.0 - 13.1 *Answer 5.9*

Many people do not enter the point in their numbers and need to be encouraged to see its importance. If all are not convinced, resorting to money values can help.

eg. is $232 the same as $23.2? etc.

The multiplication example should be straight forward.

Division could lead to a longer discussion because it is important that the numbers are said in correct order.

119.10 ÷ 3 = ?

One hundred and nineteen **divided** by 3 or
3 **into** 119.10

Some people may use different symbols. It may be worthwhile discussing these.

eg. $\frac{119.10}{3}$ $3\overline{)119.10}$

NAITB, Marr, Anderson & Tout, 1994

Let as many people as possible try to say these sentences out loud in English and make sure everyone has calculated them using the correct calculator keys.

If it has not already been done give out the ***Key words summary sheet*** for them to take home.

Part 2: Listen hear

Hand out Practice Sheet ***Calculator symbols*** which gives further practice on the key words used with calculators. You may need to explain the meaning of the word "double" as in double 0 double five, before they begin.

Activity - Listen and match

To each pair or person give one copy of Activity Sheet: ***Listen and match***. Give trainees a moment to look at it before going on. Read aloud statement number 1, then allow time for them to

- find the statement on their sheet
- put 1. beside it
- write the correct symbol in the calculator key below the statement.

The purpose here is to connect the sounds to the words and the symbols, it would be best if people could do it individually. However, if necessary allow them to work in pairs. Check that everyone knows what to do and continue reading the numbered statements until all have been read out. The suggested order for this activity is provided on the ***Listen and match - trainer's sheet***, which is on page 17.

An overhead projection transparency of the Activity Sheet: ***Listen and match*** can be a helpful way to check at the end. Allow trainees to tell you which statements they chose for each number and which key they used for each statement.

Finish off by asking trainees to use their calculators to find an answer to each statement. They can check their answers using a transparency of the Trainers' sheet.

NAITB, Marr, Anderson & Tout, 1994

Activity - Hear it right!

To each pair of trainees distribute a calculator and a pack of ***Hear it right!*** cards. The cards should be shuffled and placed between two people.

In each pair, have one trainee pick up a card and read out (but not show) the question in English. The other trainee is to enter it into the calculator and read out the answer. The trainee with the card listens and compares the answer read out to the written answer on the bottom of the card. If they agree, move on. If not, both should look at the card, review what was said and look for any mistake.

Have the trainees take turns reading a card and using the calculator until all cards have been used.

The idea here is to give people practice saying, and listening to, numbers. It will also reinforce which buttons to press.

Part 3: Further practice

Hand out Practice Sheet ***Pressing work***. This Practice Sheet allows trainees to gain confidence in locating and using the calculator keys.

It needs to be started off in the class so you can assist with any difficulties but could be finished at home for practice.

One of the main things to watch is attention to the decimal points as some people tend to ignore them.

The importance of decimal points should be stressed in this exercise. Relating it to money or to measurements relevant to trainee's work should help.

At home with calculators and ***Calculators at work*** give further practice using calculators.

NAITB, Marr, Anderson & Tout, 1994

Your notes and ideas

NAITB, Marr, Anderson & Tout, 1994

Key words

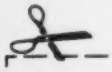
How much?

How much?

How much?

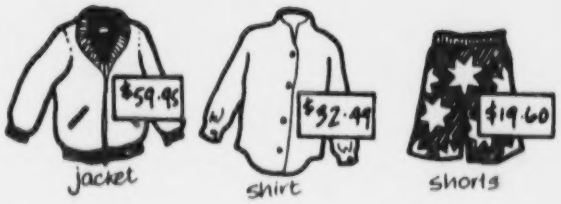
How much?

Key word cards



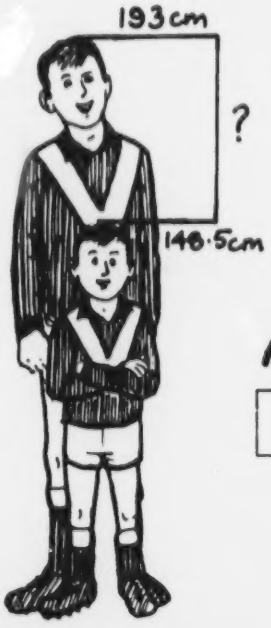
and	difference between
add	multiply
plus	times
take away	by
subtract	divide
minus	into
is	makes
equals	

Using your calculator



How much?

How much?



How much?

How much?

Key words summary sheet

plus
add

Your words:

times
multiply
by

Your words:

minus
take away
subtract

Your words:

divide
into

Your words:

zero
0

point

equals
makes
is

Calculator Symbols

1. Write the symbol from your calculator in each square.

add	☐	point	☐
zero	☐	subtract	☐
times	☐	multiply	☐
is	☐	minus	☐
take away	☐	plus	☐
by	☐	0	☐
divide	☐	makes	☐
equals	☐	into	☐

2. Fill in the blank squares. (You may not have to use all the squares each time.)

zero point six	☐☐☐☐☐
point 0 five	☐☐☐☐☐
double 0 double one	☐☐☐☐☐
one point 0 seven	☐☐☐☐☐
double 0 eight	☐☐☐☐☐
ten point 0 three	☐☐☐☐☐

Listen and match

Write down the **symbol** (+, -, x or ÷) you would use on the key below each statement.

24.6 divided by 3 _____

35.5 subtract 24.6 _____

35.5 add 24.6 _____

24.6 times 3 _____

24.6 plus 35.5 _____

3 into 24.6 _____

35.7 minus 24.6 _____

35.5 take away 24.6 _____

3 by 24.6 _____

multiply 246 by 3 _____

Listen and match- trainer's sheet

Read out the questions in the order given below. Correct the answers with the group afterwards.

3 24.6 divided by 3 **8.2**

9 35.5 subtract 24.6 **10.9**

5 35.5 add 24.6 **60.1**

6 24.6 times 3 **73.8**

2 24.6 plus 35.5 **60.1**

10 3 into 24.6 **8.2**

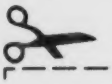
1 35.7 minus 24.6 **11.1**

4 35.5 take away 24.6 **10.9**

7 3 by 24.6 **73.8**

8 multiply 246 by 3 **738**

Hear it right!



12.6 x 3.7 Answer = 46.62 ***Forty six point six two***	**0.09 x 15** Answer = 1.35 ***One point three five***
84.09 - 57.6 Answer = 26.49 ***Twenty six point four nine***	**58.07 + 23.9** Answer = 81.97 ***Eighty one point nine seven***
273.1 + 302 Answer = 575.1 ***Five hundred and seventy five point one***	**600.1 - 493.6** Answer = 106.5 ***One hundred and six point five***
52.1 ÷ 4 Answer = 13.025 ***Thirteen point zero two five***	**72.08 ÷ 0.5** Answer = 144.16 ***One hundred and forty four point one six***

Hear it right!

15.63 + 18.42 Answer = 34.05 ***Thirty four point zero five***	**54.6 x 1.7** Answer = 92.82 ***Ninety two point eight two***
20.4 - 17.39 Answer = 3.01 ***Three point 0 one***	**24.5 ÷ 16** Answer = 1.53125 ***One point five three one two five***

Pressing work

Use a calculator to find the answer to each problem. Then, find your answer at the bottom of the page.

1. 12.4 + 25.8 = _____
2. 63.58 + 47.06 = _____
3. 29.53 - 14.88 = _____
4. 48.6 - 29.73 = _____
5. 8.7 x 6 = _____
6. 12.4 x 0.7 = _____
7. 19.6 ÷ 14 = _____
8. 2.56 ÷ 1.6 = _____
9. 19.07 + 8.98 = _____
10. 583 - 489 = _____
11. 254 + 187 = _____
12. 17 x 23 = _____
13. 7350 ÷ 24.5 = _____
14. 100.70 ÷ 19 = _____
15. 4.3 x 2.07 = _____
16. 200.07 -108.09 = _____

MIXED UP ANSWERS

14.65	94	18.87	1.6
110.64	1.4	5.3	
8.68	28.05	300	
91.98	8.901	52.2	
441	38.2	391	

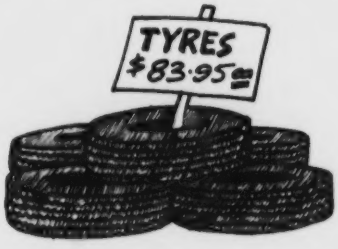
At home with calculators

Use a calculator to answer the questions. Find the answer from the list.

❶ Bill bought an air filter for $11.45 and oil for $12.85.
What was the total cost?

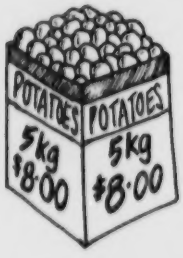
❷ How much did Joe save when he bought the washing machine on special?

❸

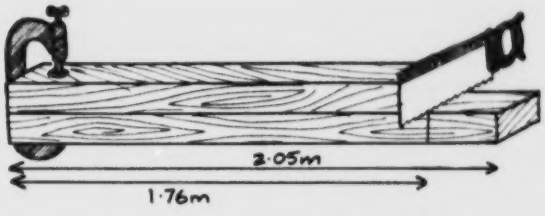


Mario bought 4 new tyres at $83.95 each.
What is 4 times $83.95?

❹ Ivan bought 5 kg of potatoes for $8.00.
How much did he pay for each kg?



❺



Dave cut a 2.05 m piece of wood down to 1.76 m.
How much did he cut off?

❻ A bag of 36 chocolate bars is shared between 8 children. How many bars does each child get?

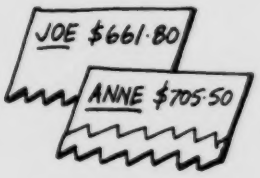
ANSWERS:

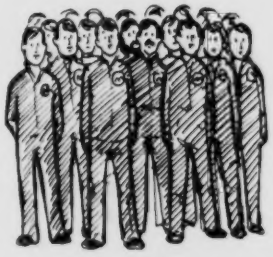
49.95 *0.29* *1.60* *24.30*
335.80 *4.5*

Calculators at work

Use a calculator to answer the questions. Find your answer from the list.

❶ Joe earns $661.80 per week.
His partner Anne earns $705.50 per week.
What is the total per week?



❷ 

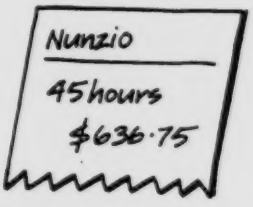
28 workers make an average of 57 car parts each per week. How many is this in total?

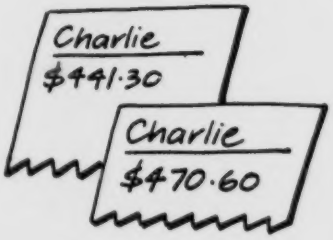
❸ 12 workers make a total of 315 parts in a day.
About how many each is this?

❹ This is part of Bill's pay slip.
What is his net pay?

Employee no.	Employee name				pay period ended	Button Motor Co. Payslip
1234	Bill Bloggs				30/ 8/93	
Rate	x hours	= taxable income	- tax	= net pay		
$12.33	x 76	= $	- $ 189.20	=		

❺ For 45 hours work Nunzio earned $636.75.
What did he earn per hour?



❻ 

Charlie now earns $470.60 per week.
Previously he earned $441.30.
How much more does he earn now?

ANSWERS:

1596 26.25 1367.30 14.15 747.88 29.30

Pressing work

1. 38.2
2. 110.64
3. 14.64
4. 18.87
5. 52.2
6. 8.68
7. 1.4
8. 1.6
9. 28.05
10. 94
11. 441
12. 391
13. 300
14. 5.3
15. 8.901
16. 91.98

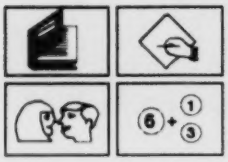
At home with calculators

❶ $24.30
❷ $49.95
❸ $335.80
❹ $1.60
❺ 0.29 m
❻ 4.5 bars

Calculators at work

❶ $1367.30
❷ 1596 parts
❸ 26.25 parts
❹ $747.88
❺ $14.15
❻ $29.30

Decimals - what's the point?



NATIONAL AUTOMOTIVE
LANGUAGE & LITERACY
COORDINATION UNIT

Decimals - what's the point?

Purpose

This is the first of two sections on decimals and this section concentrates on the first decimal place. The activities in this section are designed to clarify many aspects of decimal numbers. Part 1 looks at the meaning of the decimal point drawing on trainees' common sense and prior knowledge. Part 2 introduces rounding off decimals. The remaining part covers reading, writing, and saying decimals; how they relate to fractions; and reading and plotting decimal numbers on scales in the context of measurement and graphs.

NAITB, Marr, Anderson & Tout, 1994

Background

The first activity uses a story set in a familiar context, with everyday quantities, so that trainees can begin by finding out what they already know about placing decimal points. Beginning mathematical ideas with things people know about, makes them feel comfortable and confident to go on and learn further skills.

The first part of this activity is done in **pairs or small groups**. There are many reasons for this:

- it involves people actively at the beginning of the session rather than the trainer doing most of the talking;
- it is less threatening for most people than starting off alone;
- talking and discussing are effective ways of learning;
- there is a chance for the class members to share what they know with each other;
- people in the class who don't know where to start will not feel stupid or left out;
- it gives the trainer a chance to find out what people know, early in the session, rather than assuming they know nothing.

What to prepare

For each trainee you will need:

- a copy of the following Practice and Activity Sheets
  - ❑ ***Dials, gauges and scales***
  - ❑ ***It was one of those days***
  - ❑ ***Sensible numbers***
  - ❑ ***Looking at tenths***
  - ❑ ***Scales***
  - ❑ ***Temperature***
  - ❑ ***Bill's drive to work***
  - ❑ ***Button Industrial Estate***
  - ❑ ***Dicing with decimals - game 1***
  - ❑ ***Dicing with decimals - game 2***

Optional

Make an overhead projection transparency of each of the following sheets:

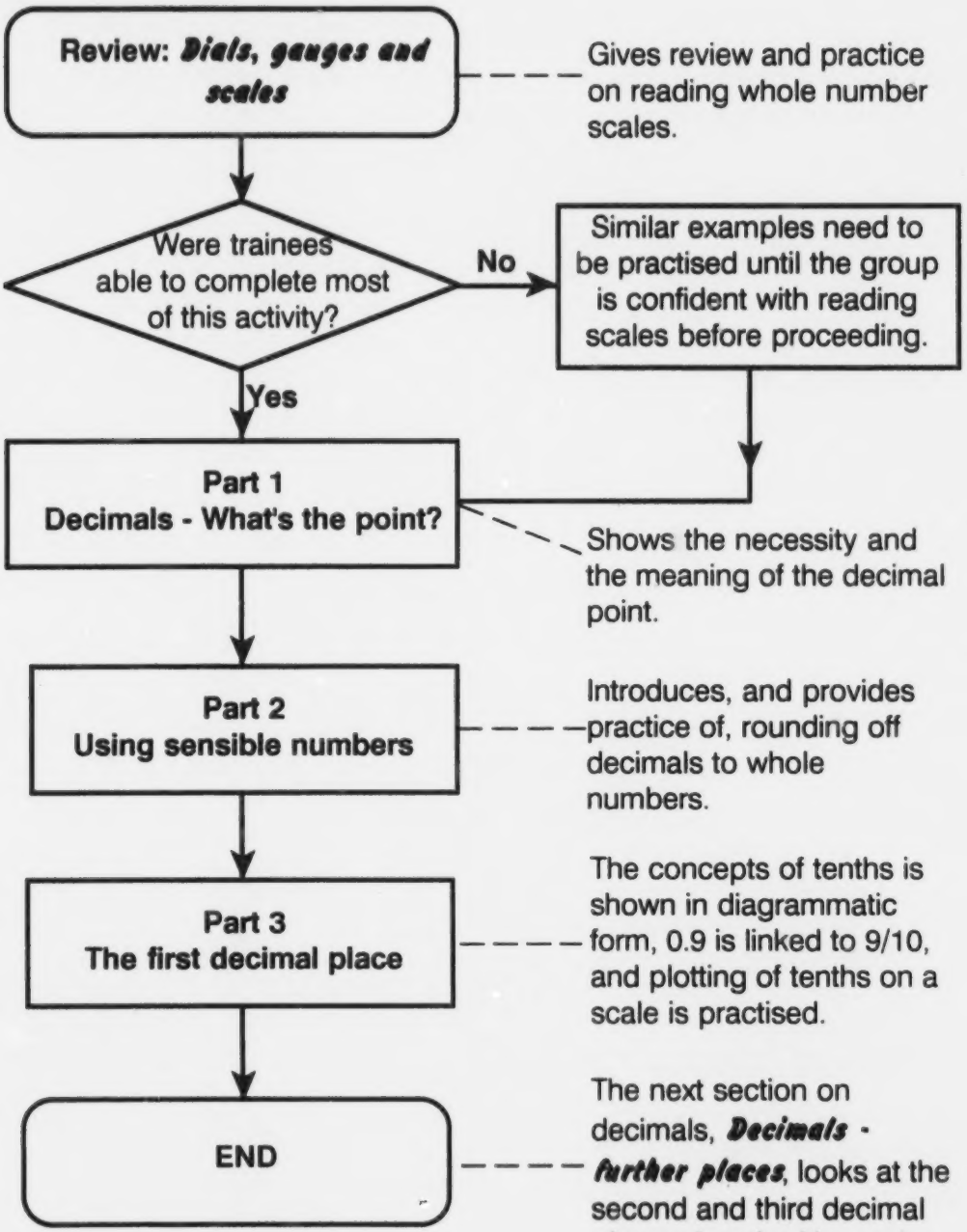
- ❑ ***It was one of those days***
- ❑ ***Temperature***
- ❑ ***Scales***
- ❑ ***Tenths grid***

Equipment needed

Dice (6 or 10 sided) - see ***Dicing with decimals***

NAITB, Marr, Anderson & Tout, 1994

Outline of section


Review: Dials, gauges and scales
Gives review and practice on reading whole number scales.
Were trainees able to complete most of this activity?
No
Similar examples need to be practised until the group is confident with reading scales before proceeding.
Yes
Part 1
Decimals - What's the point?
Shows the necessity and the meaning of the decimal point.
Part 2
Using sensible numbers
Introduces, and provides practice of, rounding off decimals to whole numbers.
Part 3
The first decimal place
The concepts of tenths is shown in diagrammatic form, 0.9 is linked to 9/10, and plotting of tenths on a scale is practised.
END
The next section on decimals, Decimals - further places, looks at the second and third decimal places, hundredths and thousandths.

NAITB, Marr, Anderson & Tout, 1994

Part 1: What's the point?

Review - Dials, gauges and scales

Ask trainees to pair up with someone they feel comfortable with. (Use small groups of 3 - 4 if you prefer). Hand out Activity Sheet: ***Dials, gauges and scales***

Ask them to work through the sheet and check their progress as you move around the room. Use this activity to decide whether the trainees are competent at reading whole number scales, before progressing onto the rest of the section. Give further practice if necessary.

Activity - It was one of those days

To each pair or group give one copy of ***It was one of these days***. Give them a chance to look at it before going on. If the reading level of the group is not good it will be helpful to read the first sentence aloud while the trainees follow it on the page.

Most of the items should be general knowledge to some people in the class. So when you go through the story let individuals supply the correct answers, rather than giving them yourself. (See below for the most likely solution.)

Ask:

- Can you see something strange in the first sentence?

Hopefully, someone will say that he is far too tall, or the engine is too big. Say that it doesn't make sense because there aren't any decimal points.

Ask:

- Can you fix the whole story by putting them in?

Give the pairs or groups a few minutes to do this before discussing their responses. (If necessary read the whole story aloud, stopping at each quantity as you go.)

Discussion may lead to some explanations of car engine size: many adults don't know that 3.9 litres is the total volume of the cylinders of a car.

The story can be used to introduce some metric units, such as how big is a litre? How tall is 1.92 metres? How tall are members of the class? You could measure everyone later, as practice.

NAITB, Marr, Anderson & Tout, 1994

If class members get stuck with the size of the petrol tank, help them use calculators to experiment with the price of petrol times size of tank, until they come up with a likely price to pay, compared to filling the tank on their own cars. Make sure everyone is satisfied about where to put the points.

Now ask:

♦ What does the decimal point actually do?

The decimal point separates the whole number part from the other part: the fraction or decimal part.

To decide where it goes we really only have to use common sense and concentrate on what is the most likely whole number part.

Answers to ***It was one of those days***.

ACTIVITY SHEET

It was one of those days

Bill who was **1.92 metres** high was excited about picking up his bright new red car with its **3.9 litre** engine.

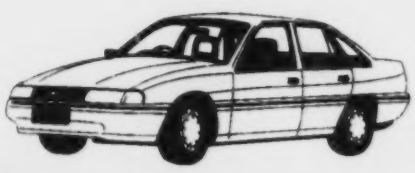
The first problem was the weather, it was a hot day. Bill, all hot and sweaty, got to the car dealer and handed over his cheque for **$21999.00**. Then he started the short, ten minute drive home, **7.6 km** away.

Bill tried to tune his new radio into FOX **101.9** FM but found he could only get AM stations. He heard the temperature was **38.7 °C**.

Just then the car spluttered to a stop - it was out of petrol.

Bill was embarrassed to be pushed into his local service station by the small **52.5 kg** woman, who was the only person to stop and help him. After quickly thanking her, he filled the car right up with **65.78 litres** of petrol at **69.8 cents per litre** and angrily paid **$45.91**.

To cool down Bill bought a **1.25 litre** bottle of Coke.



Decimals - what's the point? — *NAITB, Marr, Anderson & Tout, 1994* — p. 14

NAITB, Marr, Anderson & Tout, 1994

Part 2: Using sensible numbers - rounding off

Ask:

- If Bill was telling a friend how much he paid for the car, what would he be likely to say?

Discuss with the class how people usually talk about numbers.

With trainees working in their small groups or pairs -

Ask:

- If you were to rewrite the story without decimal points, how would the numbers be written to be the most dramatic but still accurate?

People usually try to keep stories interesting by rounding off - this makes it easier to get an idea of how big the amount is, such as saying 'twenty-two thousand dollars' instead of giving the exact price of $21,999.

Alternatively, ask:

- Suppose you didn't have a '.' on the typewriter, how could you use whole numbers to keep the facts true but interesting?

When they are doing this encourage the trainees to talk a lot and exchange ideas. Saying kilometres and kilograms in full should be stressed in order to practise the language aspects of metric measurement. Also encourage trainees to use common sense, and appropriate real language to give responses such as:

Bill is **nearly 2** metres tall (very tall)
His car's engine is **almost 4** litres
He paid **22 thousand** dollars ($22,000)
He lived **about 8** kilometres away.

We can't really round off 101.9 but to find it on the dial we would look at **about 102.**

The temperature was **almost 40°C.**

NAITB, Marr, Anderson & Tout, 1994

The small woman: 52.5 kg **could be called 52 $^1/_2$** kilograms or **rounded up to 53** kilograms.
(Mention that it is common practice to **round up** to the next whole number when **at a half or more**).

Common practice is to round up for decimals point five or over, and round down for those under point five.

He put about **66 litres** of petrol in.
Petrol cost **nearly 70** cents per litre.
Bill paid **almost $46.**

The large coke was **over a litre.** (Notice that for decimals **less than one half** (.5) we tend to **round down.**)

The Practice Sheet ***Sensible Numbers*** can now be used to reinforce these ideas either in class or at home. However, make sure that you discuss the choices of words with the group afterwards. There are no unique correct answers but choices such as 'just over' or 'just under' would be inappropriate in some cases.

Part 3: The first decimal place

Presentation

Ask:

- Which numbers in ***It was one of those days*** had only one number after the decimal point?

Write these down on the board:

3.9, 7.6, 101.9, 38.7, 52.5, 69.8

Circle the numbers after the decimal point:

3.(9) 7.(6) 101.(9) 38.(7) 52.(5) 69.(8)

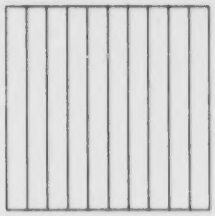
saying that we call this the **first** decimal place.

Ask:

- What do these numbers after the decimal point mean?
- How do you say these numbers?

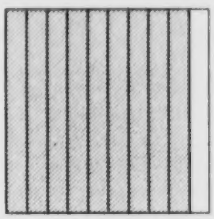
NAITB, Marr, Anderson & Tout, 1994

Draw the following grid on the board or use a transparency of the grid supplied on page 36.



Ask:

- Can we show .9 on this grid?
- How many strips do we have to shade in?



When you have shaded 9 out of the 10 spaces ask:

- How can we write 9 out of 10?
- How do you say it?

On the black board write:

9 out of 10 = $^{9}/_{10}$

said as nine tenths

Link
0.9 = $^{9}/_{10}$
0.9 = nine tenths

Refer back to the numbers on the board 3.9, 7.6, etc. and ask class members to say them aloud both ways. So they would verbalise both:

3.9 - three point nine
and $3^{9}/_{10}$ - three and nine tenths.

Write some other numbers with one decimal place, such as 5.7, 22.3, 19.6, on the board and get trainees to take turns to read them out loud - again encourage saying them as decimals: 'five point seven', and as fractions: 'five and seven tenths'.

Also ask them to write the numbers in mixed fraction form:

$5.7 = 5^{7}/_{10}$

Hand out the Practice Sheet: ***Looking at tenths.***

NAITB, Marr, Anderson & Tout, 1994

Activity - Scales

Hand out Practice Sheet: ***Scales***
Together look at the first example 3.9 which is done for them. If necessary draw the scale roughly on the board or use an overhead projector transparency of the worksheet.

Once this is understood ask trainees to plot the other 5 decimals on the appropriate scales.

Some trainees might have difficulty with the graduations on scales. You may need to go through this carefully and provide further numbers such as 51.1, 70.3 etc. for them to plot until they are confident.

The main point here is that to plot tenths, you need to divide each whole number part into ten equal bits. Trainees should be encouraged to take time to examine the scale to find out if it is marked out in .1 intervals or .2 intervals before plotting the measurement.

Hand out Practice Sheet: ***Temperature*** which gives further practice at plotting and reading scales. It can be used as a class activity or as a take home exercise to reinforce plotting on scales.

Activity - Bill's drive to work

Hand out Activity Sheets: ***Bill's drive to work*** and ***Button Industrial Estate.***
Get trainees to work in pairs through each of the questions. By walking around, listening and observing, check that trainees understand the mathematical content involved.

Activity - Dicing with decimals

You could play the games ***Dicing with decimals*** - games 1 and 2. These games are designed to increase trainees' understanding of decimal place value, enhance their skills at estimation with decimals, and to provide a quick chance to teach or revise addition of decimals.

They can be introduced at any time after the introduction to the first decimal place, and would probably be best suited to be used in the first or last 10-15 minutes of a session to begin or finish it in a positive way.

NAITB, Marr, Anderson & Tout, 1994

The games can be played with either a normal 6 sided dice or a 10 sided dice. (10 sided dice can be found in most games shops. They are good mathematical tools because they have all of the digits from 0 to 9.)

Game 1

To each trainee hand out a copy of Game 1.
Explain that the aim of the game is to get a total **as close to**, but **not more than** 9.9
A score greater than 9.9 will put you out of that game or as they say in 'pontoon' or '21' you have gone 'bust'.

Read out the procedure for the game:

- I will toss the dice once.
- You have to write the number in the first line in the space you choose, either before or after the decimal point.
- I will toss the dice again and we will repeat the process until you have seven numbers written.
- Now add the numbers to find your total.
- If you are over 9.9 you are out or bust.
- The closest total to 9.9 is the winner.

On a sheet of four games the first one could be used for a practice round. The other three games then can be used competitively - with a winner decided each game.

Extension

To include subtraction skills in the game you can get an overall score for three games as follows.

For each game, every player **subtracts** their total from 9.9 In other words they find the difference between their total and 9.9 This becomes the **score** for that game.

At the end the three scores are added, and the person with the **lowest** score wins.

A person who has 'busted' in a game cannot be an overall winner but may be a winner of individual games.

Examples of the play are shown below:

A six sided die was used.

Number rolled	Player A	Player B
5	5	5
2	2	2
6	6	6
4	4	4
3	3	3
5	5	5
4	4	4
	10 1	8 3
	Target 9.9	Target 9.9

Player A went out or bust **Player B** wins

Optional:
Player B has a **score** of 9.9
- 8.3
1.6

Score is 1.6

Game 2

Hand out a copy of the game sheet to each person.

Explain the rules of the game:

- This time I will toss the dice 6 times.
- Each time I toss it you have to fill in one space in the grid.
- This must be done before the dice is tossed again.
- The space you fill can be anywhere above the double line - this time it doesn't need to be line 1, then line 2 etc.
- At the end of 6 tosses all of the spaces should be filled in.
- Now all the numbers should be **added** as in game 1.
- If you are over 9.9 you are out.
- The closest to 9.9 wins the round.

Extension

- Scores can be worked out as in game 1 - the difference between your total and 9.9 is your score.

Examples of play are shown below. A six sided dice was used.

Numbers rolled	Player A	Player B
4,5,3,2,1,1	4 • 5 3 • 1 2 • 1 9 • 7	3 • 4 2 • 5 1 • 1 7 • 0
	Target 9.9	Target 9.9
	Optional Score 9.9 -9.7 0.2	Optional Score 9.9 -7.0 2.9

Player A wins the round with the lowest score of .2

Your notes and ideas

NAITB, Marr, Anderson & Tout, 1994

Dials, gauges and scales

Can you read these?

1.

_____ litres

2.

_____ volts

3.

_____ °C

4.

_____ kPa

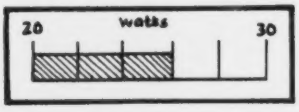
5.

_____ °C

6.

_____ mg

7.

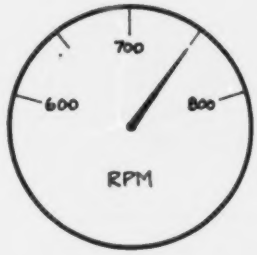


_____ watts

8.

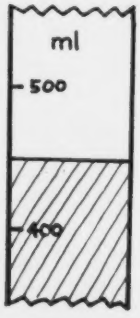
_____ kg

9.



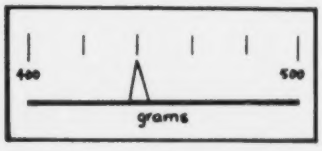
_____ RPM

10.



_____ mL

11.



_____ 48 grams

12.

_____ cc

It was one of those days

Bill who was **192 metres** high was excited about picking up his bright new red car with its **39 litre** engine.

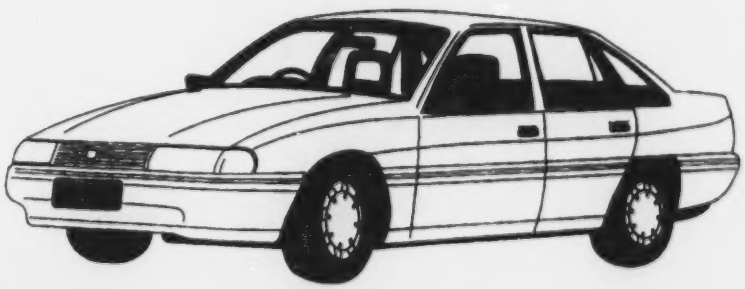
The first problem was the weather, it was a hot day. Bill, all hot and sweaty, got to the car dealer and handed over his cheque for **$2199900** . Then he started the short, ten minute drive home, **76 km** away.

Bill tried to tune his new radio into FOX **1019** FM but found he could only get AM stations. He heard the temperature was **387 °C**.

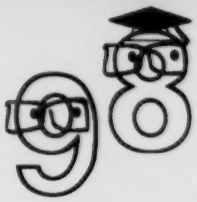
Just then the car spluttered to a stop - it was out of petrol.

Bill was embarrassed to be pushed into his local service station by the small **525 kg** woman, who was the only person to stop and help him. After quickly thanking her, he filled the car right up with **6578 litres** of petrol at **698 cents per litre** and angrily paid **$4591**.

To cool down Bill bought a **125 litre** bottle of Coke.



Sensible Numbers



Make a new sentence for each statement using **whole numbers** - no decimals.

Choose from:

about	*nearly*	*almost*	*approximately*
just over		*just under*	*a bit over*

Example:

Rump steak was $7.95 per kilo.

A kilo of rump steak was ***almost $8.00.***

1. Swiss cheese was $5.99 a kilo.

   A kilo of swiss cheese was _____

2. Carlos weighed himself. He read 71.6 kilograms.

   Carlos weighs _____

3. The trip meter of my car showed 22.2 kilometres to Ford.

   My trip to Ford was _____

4. Michelle's new jacket cost $45.90.

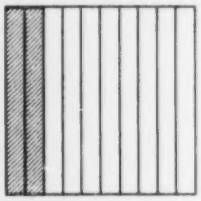
   The jacket cost _____

5. The stop watch read 38.2 minutes to machine a part.

   It takes _____

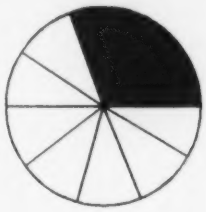
Looking at tenths

1. Give the fractions that are shaded in each of the grids.



a. Shaded area:

$\frac{\quad}{10} = 0.\_\_$



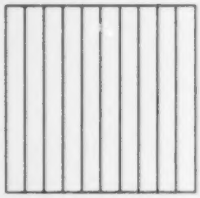
b. Shaded area:

$\frac{\quad}{10} = 0.\_\_$

c. Shaded area

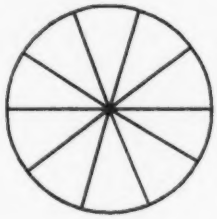
$\frac{\quad}{10} = 0.\_\_$

2. Shade the fraction in on the grid or circle.



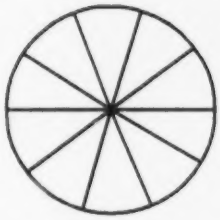
a. Shade in

$0.6 = \frac{\quad}{10}$



b. shade in

$\frac{8}{10} = 0.\_\_$



c. shade in

$\frac{10}{10} = \_\_\_\_$

d. Shade in $1.2 = 1\frac{\quad}{10}$

e. shade in $2.6 = 2\frac{\quad}{10}$

3. Use a calculator to find:

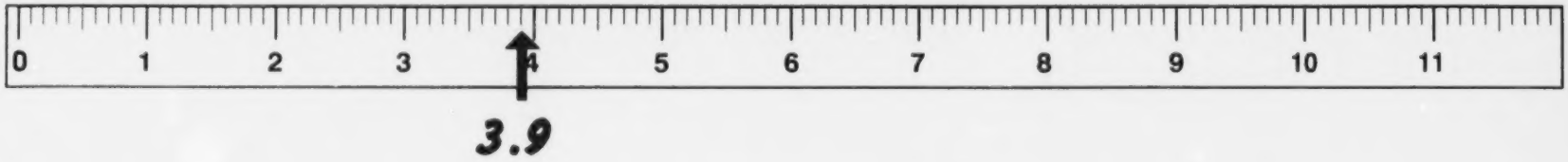
a. $\frac{9}{10}$ is the same as [9] [÷] [1] [0] [=] _____

b. $\frac{16}{10}$ is the same as [1] [6] [÷] [1] [0] [=] _____

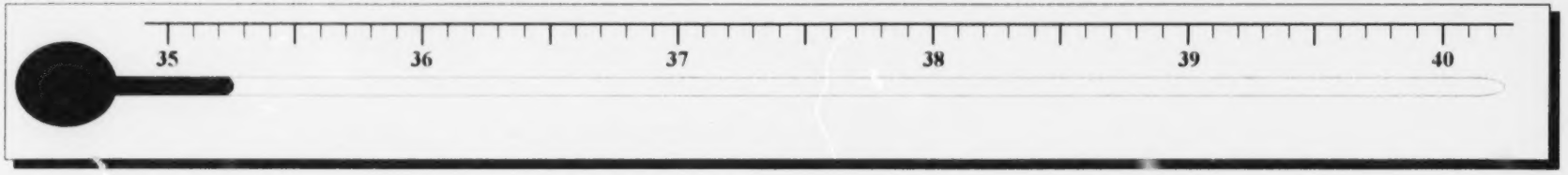
Scales

Mark on the scales these numbers: **38.7, 7.6, 101.9, 52.5,** and **69.8**
3.9 is done as an example.

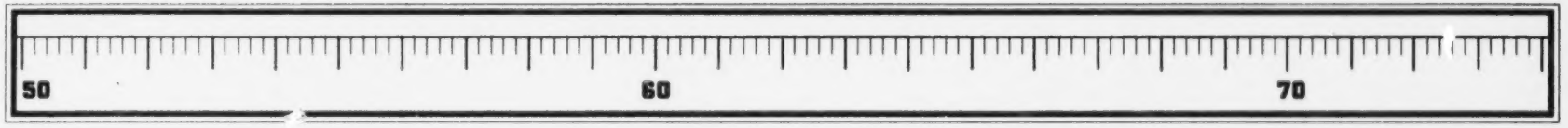
❶



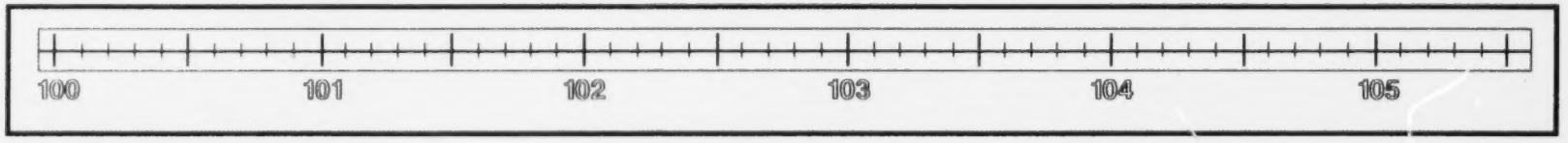
❷



❸



❹



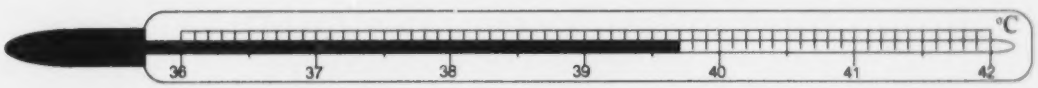
NAITB, Marr, Anderson & Tout, 1994

Temperature

1. The average daily temperature during April was **twenty three point one °C**. Write this temperature in figures.

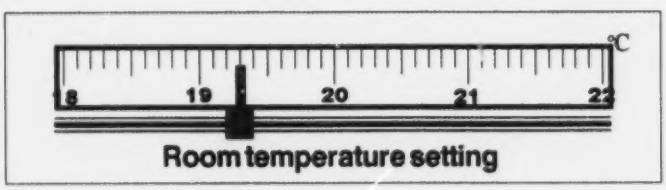
_____

2. Ludmilla had her temperature taken.
The thermometer looked like:



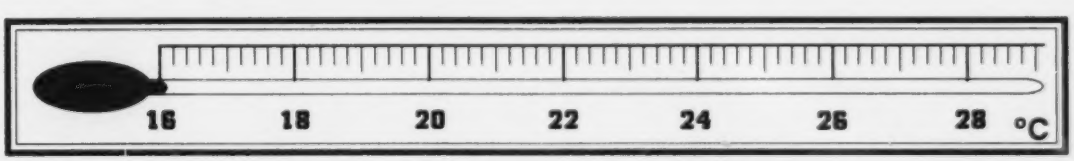
What was her temperature? _____

3. For what temperature is this thermostat set?

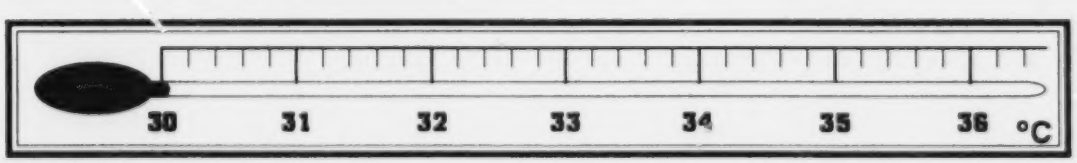


Setting: _____

4. A comfortable room temperature is **20.8°C**.
Show this on the thermometer.



5. A summer temperature was **32.7°C**.
Show this on the thermometer.



Bill's drive to work

Bill works at the Button Car Company. Use the map ***Button Industrial Estate*** to answer the following questions.

❶ Bill turns right from **Marr Road** and heads north along **David Drive**. How far is it from **Marr Road** to these spots?

a. The **picnic and sports ground entrance**. 1.5 km

b. The road into the **Durable Tyre Co**. ____•____

c. **Anderson Street**. ____•____

d. The **Button Car Factory entrance.** •

e. The **Club Hotel exit.** ____•____

❷ Now write your answers to ❶ in **fractions.**

a. 1.5 = $1\frac{5}{10}$ b. ____•____ = _____

c. ____•____ = _____ d. ____•____ = _____

e. ____•____ = _____

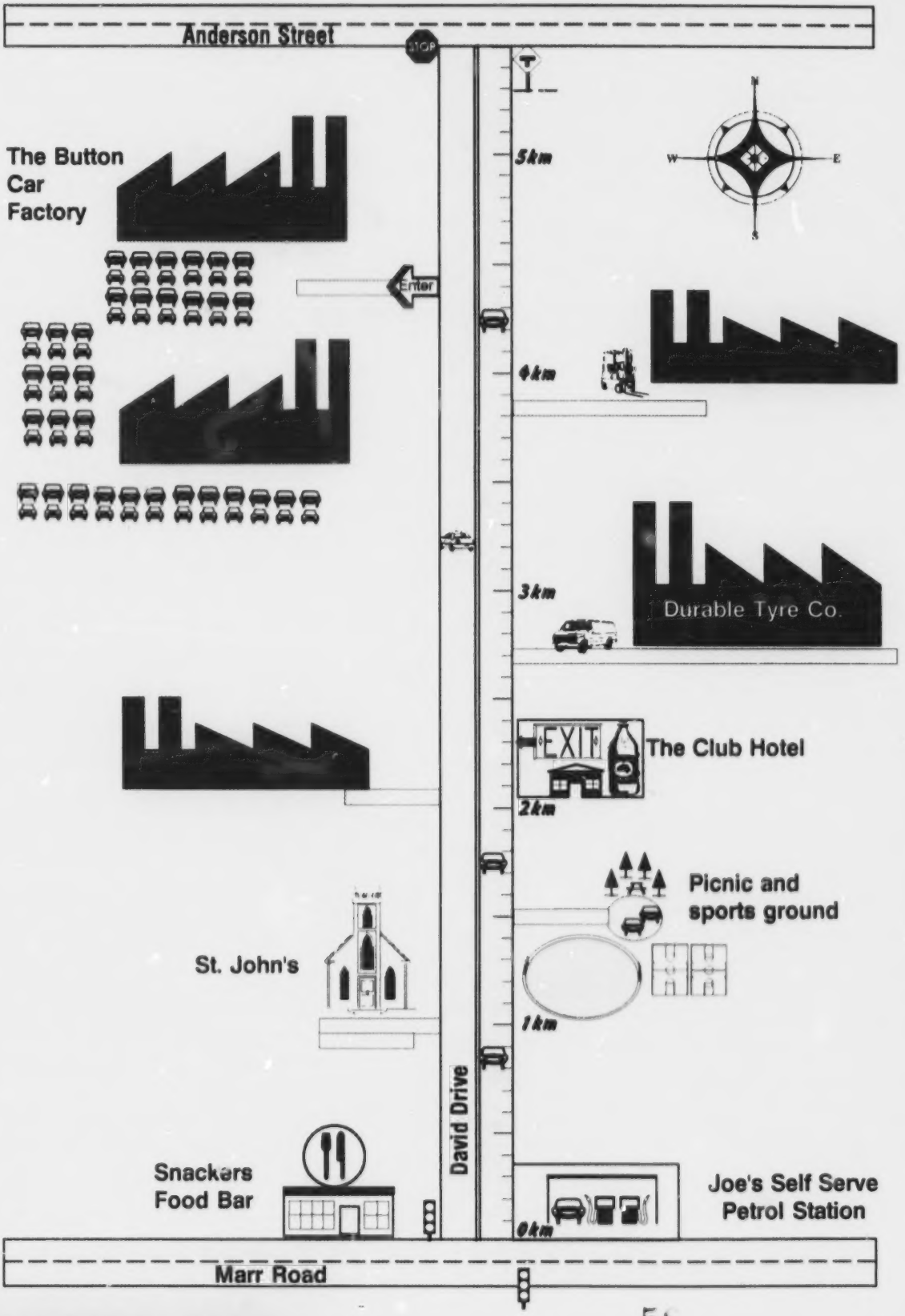
❸ How far is it between the following spots?

a. From **St. Johns** to the **Button Car Factory**.

b. From the **Club Hotel exit** to **Anderson Street**.

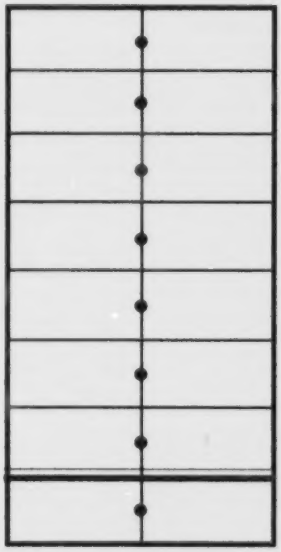
c. From the **Picnic and sports ground** to the **Button Car Factory entrance**.

Button Industrial Estate

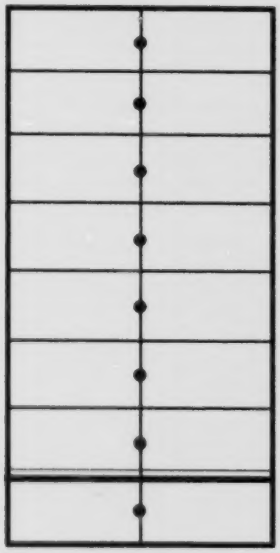


Dicing with decimals - game 1

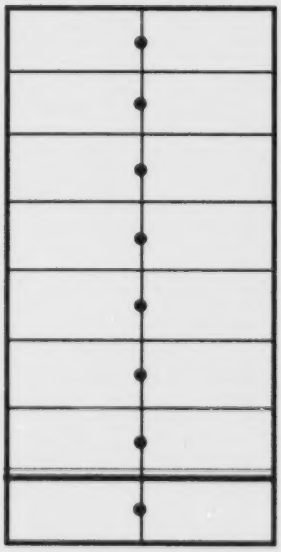
7 throws. Target is 9.9



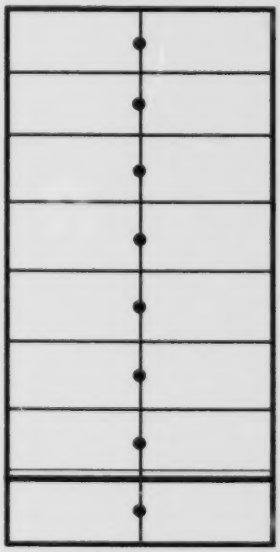
Target: 9.9



Target: 9.9



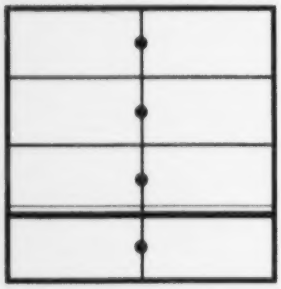
Target: 9.9



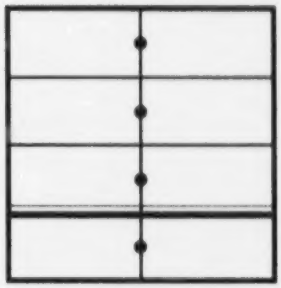
Target: 9.9

Dicing with decimals - game 2

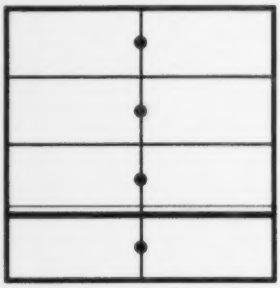
6 throws. Target is 9.9



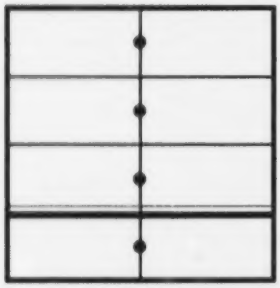
Target: 9.9



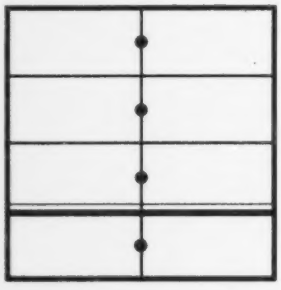
Target: 9.9



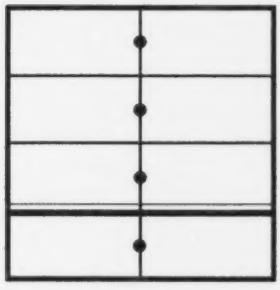
Target: 9.9



Target: 9.9

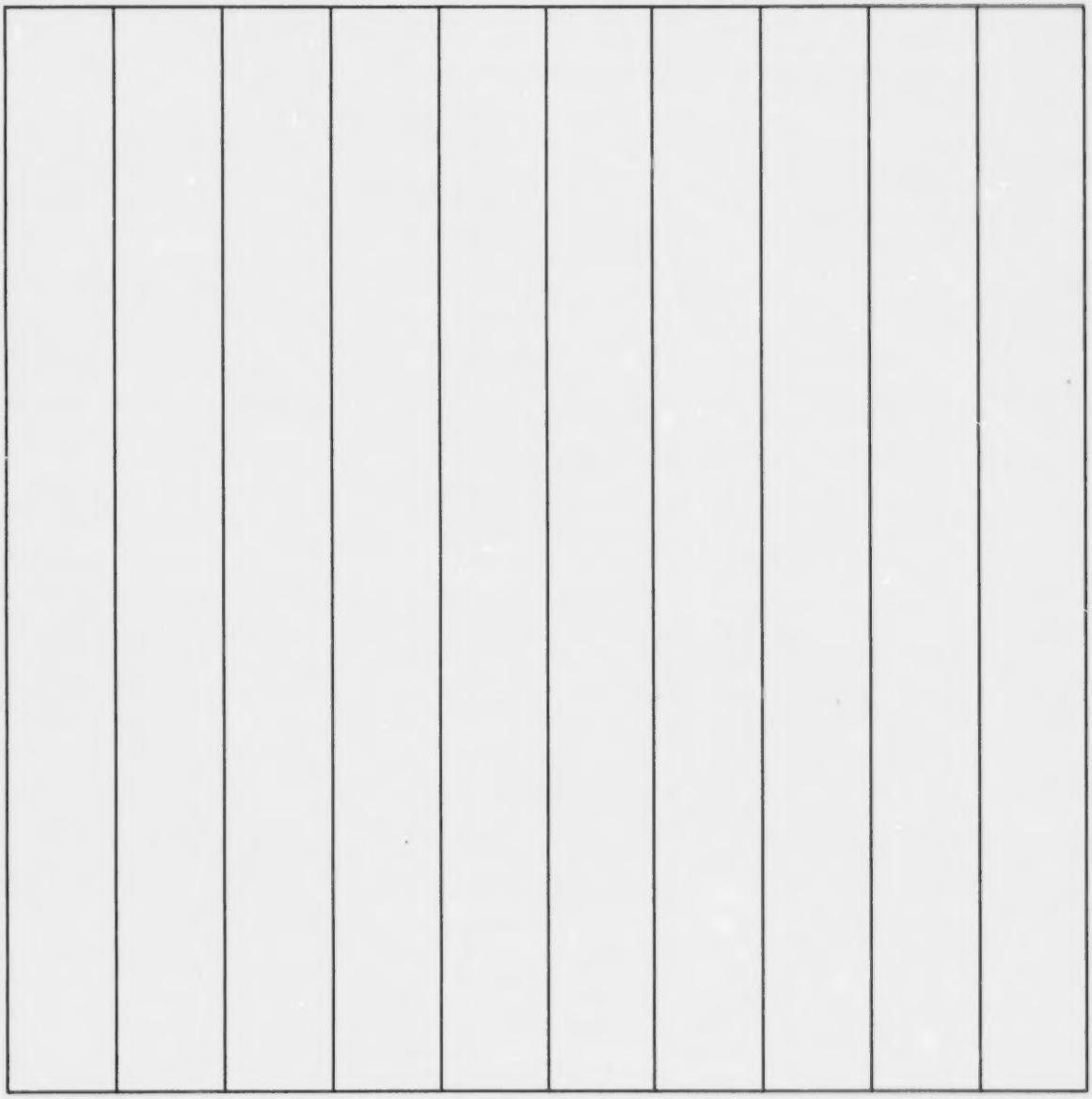


Target: 9.9



Target: 9.9

Tenths grid



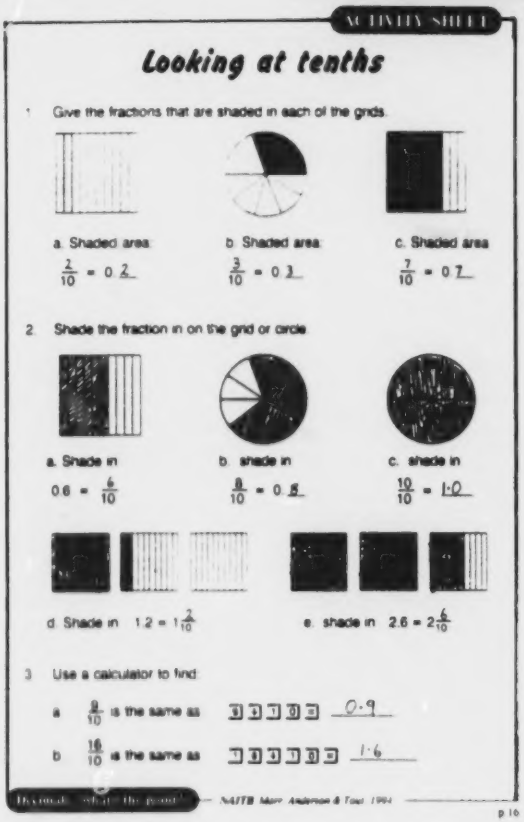
Dials, gauges and scales

1.	15 litres	7.	26 watts
2.	14 volts	8.	54 kg
3.	27°C	9.	750 RPM
4.	170 kPa	10.	450 mL
5.	75°C	11.	440 grams
6.	40 mg	12.	1380 cc

Sensible numbers

Different words could be used. The answers should be discussed as a group.

1. _____ $6 a kilo
2. _____ 72 kilograms
3. _____ 22 kilometres
4. _____ $46
5. _____ 38 minutes



ACTIVITY SHEET

Looking at tenths

1. Give the fractions that are shaded in each of the grids.

a. Shaded area $\frac{2}{10} = 0.2$ b. Shaded area $\frac{3}{10} = 0.3$ c. Shaded area $\frac{7}{10} = 0.7$

2. Shade the fraction in on the grid or circle.

a. Shade in $0.6 = \frac{6}{10}$ b. shade in $\frac{8}{10} = 0.8$ c. shade in $\frac{10}{10} = 1.0$

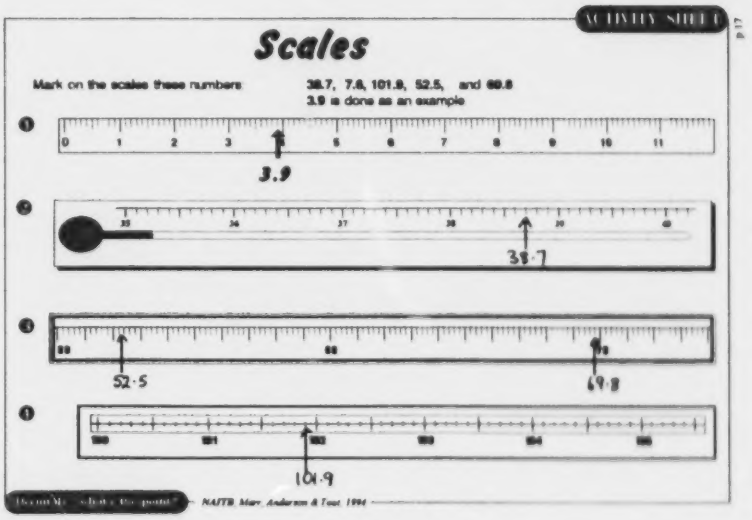
d. Shade in $1.2 = 1\frac{2}{10}$ e. shade in $2.6 = 2\frac{6}{10}$

3. Use a calculator to find:

a $\frac{9}{10}$ is the same as 0.9

b $\frac{16}{10}$ is the same as 1.6

Decimals - what's the point? NAITB, Marr, Anderson & Tout, 1994 p.16



ACTIVITY SHEET p.17

Scales

Mark on the scales these numbers: 38.7, 7.6, 101.9, 52.5, and 69.8
3.9 is done as an example

3.9

38.7

52.5

69.8

101.9

Decimals - what's the point? NAITB, Marr, Anderson & Tout, 1994

Bill's drive to work

❶ b. 2.7 km c. 5.5 km
d. 4.4 km e. 2.3 km

❷ b. $2\frac{7}{10}$ c. $5\frac{5}{10}$
d. $4\frac{4}{10}$ e. $2\frac{3}{10}$

❸ a. 3.4 km b. 3.2 km
c. 2.9 km

PRACTICE SHEET

Temperature

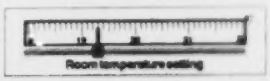
1. The average daily temperature during April was twenty three point one °C. Write the temperature in figures

23·1°C

2. Ludmilla had her temperature taken. The thermometer looked like

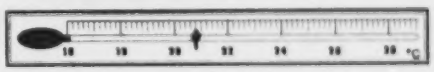
What was her temperature? 39.7°C

3. For what temperature is the thermostat set?

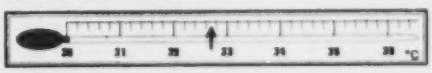


Setting 19.3°C

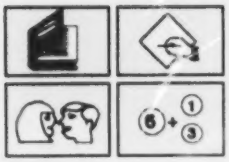
4. A comfortable room temperature is 20.6°C. Show this on the thermometer



5. A summer temperature was 32.7°C. Show this on the thermometer



Decimals - further places



NATIONAL AUTOMOTIVE
LANGUAGE & LITERACY
COORDINATION UNIT

Decimals - further places

Purpose

This is the second section on decimals. It introduces the second and third decimal places in two parts which cover: reading, writing, and saying decimals; how they relate to fractions; comparing their values; and reading and plotting decimal numbers on scales in the context of measurement and graphs.

NAITB, Marr, Anderson & Tout, 1994

What to prepare

For each trainee you will need:

- a copy of the following Practice and Activity Sheets
  - ❑ ***Looking at hundredths***
  - ❑ ***How tall is 1.92 metres?***
  - ❑ ***Paint thickness***
  - ❑ ***Hundredths - the second decimal place***
  - ❑ ***Data sheet***
  - ❑ ***Rounding off***
  - ❑ ***Reading thousandths***
  - ❑ ***Decimal place value chart***
  - ❑ ***Dicing with decimals - game 3***

For each group of 3 or 4 trainees:

- photocopy ***Double zero three and nine activity***, part 1 and part 2. It is preferable to photocopy them onto a different coloured card for each page. Cut the pieces up and place into envelopes or plastic bags labelled:
  - ❑ ***Double zero three and nine - part 1***
  - ❑ ***Double zero three and nine - part 2***

- prepare separate labelled envelopes or plastic bags containing one set of the cut up cooperative logic activities and a set of the digits from page 28:
  - ❑ ***What's the number? - 1, 2 3 and 4***
  - ❑ ***What's the number? - numbers***

It is best to photocopy each of these activities onto different coloured cardboard.

Optional

Make an overhead projection transparency of each of the following sheets:

- ❑ ***Paint thickness***
- ❑ ***100 square grid***

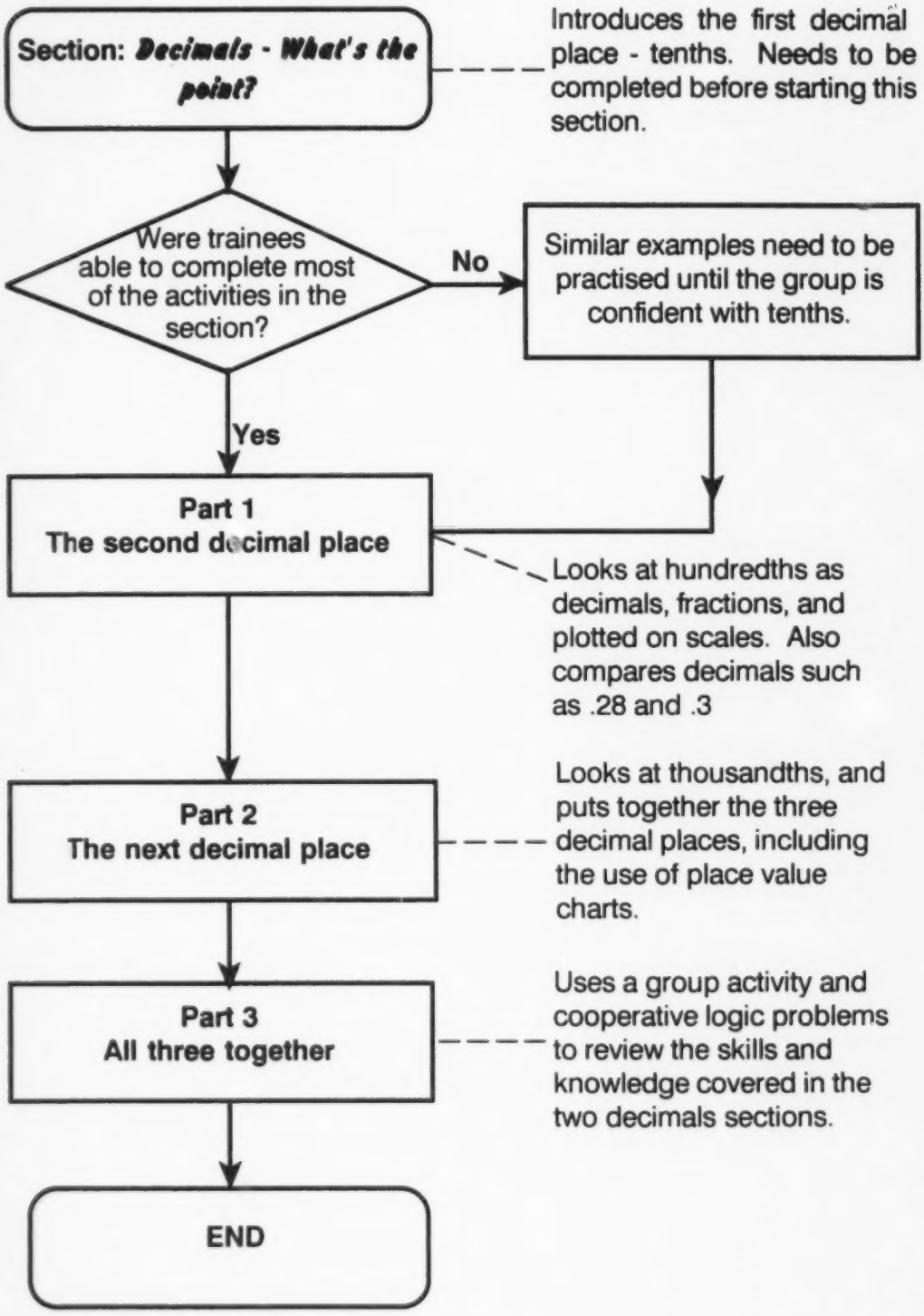
Equipment needed

Dice (6 or 10 sided) - see ***Dicing with decimals***

Tape measures - see ***How tall is 1.92 metres?***

NAITB, Marr, Anderson & Tout, 1994

Outline of section


Section: Decimals - What's the point?
Introduces the first decimal place - tenths. Needs to be completed before starting this section.
Were trainees able to complete most of the activities in the section?
No
Similar examples need to be practised until the group is confident with tenths.
Yes
Part 1
The second decimal place
Looks at hundredths as decimals, fractions, and plotted on scales. Also compares decimals such as .28 and .3
Part 2
The next decimal place
Looks at thousandths, and puts together the three decimal places, including the use of place value charts.
Part 3
All three together
Uses a group activity and cooperative logic problems to review the skills and knowledge covered in the two decimals sections.
END

NAITB, Marr, Anderson & Tout, 1994

Part 1: The second decimal place

Presentation

Get trainees to refer back to ***It was one of those days*** from ***Decimals - What's the point?***

Ask:

- Which numbers in this have two figures after the decimal point?

Write these on the board:

1.92 21999.00 65.78 45.91 1.25

Ask:

- How do you say these?
- Remember that 3.9 can be said as "three and nine tenths"
- Can you say these numbers as fractions?

Discuss the different ways of saying and writing these.

1.92 - one point nine two

or

$1\ ^{92}/_{100}$ - one and ninety two hundredths.

Encourage trainees to use 'ninety-two hundredths' as well as 'point nine two'.

Discuss that the second decimal place indicates hundredths, written as $^{1}/_{100}$ ths eg. $^{2}/_{100}$ is two hundredths which has a much smaller value than two tenths.

Using your transparency refer back to the grids from the tenths exercise.

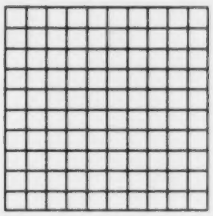
Ask:

- How could we show $^{1}/_{100}$ on this grid?
- How many squares would we need?

Hopefully trainees will tell you that you would need to divide the strips into 10 pieces as well.

NAITB, Marr, Anderson & Tout, 1994

Draw a 100 square grid on the board or use one on an overhead projector transparency (see page 15).



Ask trainees to explain how you could use this grid to show $^{1}/_{100}$, $^{2}/_{100}$, $^{92}/_{100}$ etc. (shading in 1, 2, 92 out of 100 spaces).

Ask trainees to use question 1 on the Practice Sheet: ***Looking at hundredths*** to shade in the decimal parts of the other numbers on the board .78 .25 .91

Also get them to write the number as a fraction in the space below the grids. Similarly they should do question 2, writing the decimals in fraction form.

As a group go through their responses to the first two questions on the sheet and ask them to say the numbers aloud both in decimal and fraction form.

Ask:

- Why shouldn't you say point "twenty-eight?"

Trainees should be discouraged from pronouncing 6.28 as six point twenty-eight because it sounds so much more than, say, six point three (6.3), but of course it is not.

Now ask:

- What would a number like .03 look like on the grid?
- What fraction is it?
- Is the zero important?
- Why?

Ensure that everyone understands that .03 is $^{3}/_{100}$ and that it is much smaller than $^{3}/_{10}$. Compare on the 100 grids if necessary.

Emphasize the importance of the 0 in .03 to tell us the small size of the number.

Trainees should complete the Practice Sheet by shading in the .03, .09, and .20 examples, and writing out questions 3 and 4 as fractions.

NAITB, Marr, Anderson & Tout, 1994

To finish off, write some more numbers with one and two decimal places, such as 6.28, 5.4, 15.73, 11.06, 40.5 on the board, and get trainees to take turns to say them out loud - encourage them to say them as digits, "six point two eight" and as fractions, "six and twenty-eight hundredths, or five and four tenths."

As they do this ask them also to write them down as fractions. eg. $6\,^{28}/_{100}$, $5\,^{4}/_{10}$, and to make a rough sketch of them using a quick grid. Drawing a grid for themselves as a final step will reinforce the difference between tenths and hundredths and allow you to see if the group members really have understood the concepts.

Activity - How tall is 1.92 metres?

Say:

Remember Bill from the ***It was one of those days*** story?

- He was 1.92 metres tall.

Ask:

- Is there anyone here taller than Bill?
- How tall is 1.92 metres?
- Do you know your own height?
- Do you know it in metrics?

You may need to discuss the relationship between metres, centimetres and decimal fractions with the class.

Use their responses to link 1.92 metres and 1 metre 92 centimetres. (Centimetres are hundreths of a metre.)

Hand out the ***How tall is 1.92 metres?*** Activity Sheet.

Get trainees to work in pairs and encourage them to discuss their responses. Allow time for people to measure their heights and complete the sheet.

Encourage people to measure their height even if they think they know it already because they should have a chance to practise reading from the tape measure.

Ask:

- Who is the tallest here?

Write all the heights on the board as decimals and get trainees as a whole group to put the heights in order.

To further reinforce the language and understanding of the second decimal place hand out the ***Paint thickness*** Practice Sheet.

NAITB, Marr, Anderson & Tout, 1994

When trainees have completed the sheet, check their understanding by roughly drawing the line on the board or using a prepared OHP transparency of the practice sheet and getting trainees to tell you where to plot the paint thicknesses.

Check that they know which thicknesses are below 0.85 mm or above 1.15 mm. Also use the sheet to check the use of subtraction when subtracting the smallest value from the biggest to work out the range

Activity - Dicing with decimals

Game 3 extends the thinking from Dicing with decimals - games 1 and 2, into the second decimal place. It also emphasises the small value that numbers in the hundredths space really have.

Game 3

It follows the same rules as Game 2 except that the dice will be tossed nine times and there are nine spaces to be filled in. The target in 9.99

This game really tests players strategies and understanding, as, on the whole, high numbers need to be put in the third column (the hundredths) tc avoid going out.

Hand out a copy of the game ***Dicing with decimals*** - game 3 to each person.

Explain the rules of the game:

- This time I will toss the dice 9 times.
- Each time I toss it you have to fill in one space in the grid.
- This must be done before the dice is tossed again.
- The space you fill can be anywhere above the double line - this time it doesn't need to be line 1, then line 2 etc.
- At the end of 9 tosses all of the spaces should be filled in.
- Now all the numbers should be **added** as in game 1 and game 2.

NAITB, Marr, Anderson & Tout, 1994

- If you are over 9.99 you are out.
- The closest to 9.99 wins the round.

Extension

- Scores can be worked out as in games 1 and 2 (see ***Decimals - What's the point?***) the difference between your total and 9.9 is your score.

Examples of play are shown below. A six sided dice was used.

Numbers rolled	Player A	Player B
4,5,3,2,1,1,6,3,5	5 . 4 | 2 1 . 3 | 6 3 . 1 | 5 9 . 9 | 3	4 . 5 | 3 2 . 6 | 1 1 . 5 | 3 8 . 6 | 7
	Optional Score 9.99 -9.93 0.06	**Optional Score** 9.99 8.67 1.32

Player A wins the round with the lowest score of 0.06.

Finish off by handing out ***Hundredths - the second decimal place*** Practice Sheet, which reviews and reinforces the ideas covered so far.

Part 2: The next decimal place

Review

Handout ***Data sheet*** and ***Rounding off*** Activity Sheets and use these to review the first and second decimal places before starting on the third decimal place - thousandths.

NAITB, Marr, Anderson & Tout, 1994

Presentation

Say:

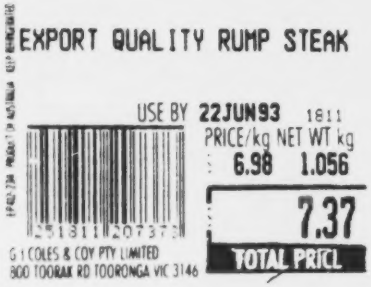
So far we have looked at the first two decimal places.
The first decimal place is the tenths.
The second is the hundredths.

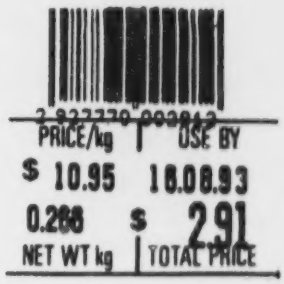
Ask:

- ♦ Do you know what the next decimal place represents?
- ♦ What numbers do you know of that use three decimal places?
  - Anything you buy?
  - Anything you see at home or use at work?

Use trainees answers to collect some applications that use thousandths. Some examples could be:

❶ Weights of shopping items: kilogram, kg and gram, g.

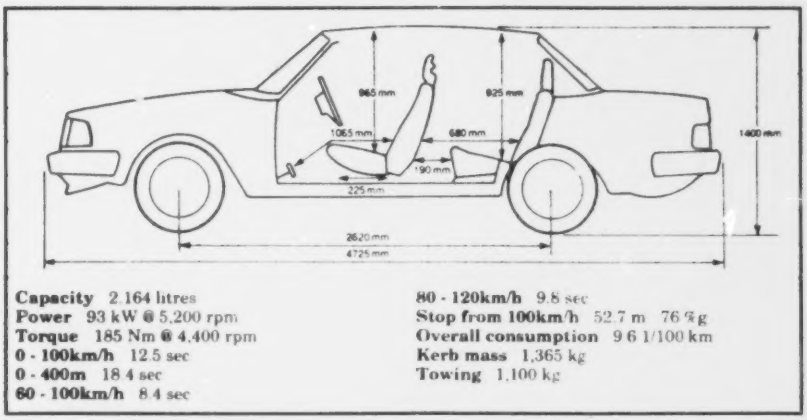




1.056kg = 1kg 56g

0.266kg = 266g

❷ Lengths in metre, m and millimetre, mm. For example from car sizes:



e.g. 4725 mm = 4.725m

NAITB, Marr, Anderson & Tout, 1994

Hand out Practice Sheet ***Reading thousandths***, which gives practice at writing decimals to three decimal places.

Activity - Decimal place value chart

Use the ***Decimal place value chart*** sheet to work through writing decimal fractions as both digits and words.

Work through the first three examples (done on the sheet) with the group. Discuss any issues that arise - particularly about putting in the zeros.

It is often useful to be able to relate decimals and their meaning to a grid called a place value chart. This helps particularly when there are zeros after the decimal point.

Get trainees to fill in the gaps in the rest of the ***Decimal place value chart***.

There is a blank ***Decimal place value chart*** included on page 25 if you need it for further practice. You could read out numbers and ask trainees to fill them in on the sheet.

In particular, get trainees to look at parts g), h), i), which are all variations of 5.8.

When comparing numbers to see which is bigger it is often helpful to add zeros to the end of the digits after the decimal point eg. 1.9 compared to 1.92 Think of 1.9 as 1.90, and therefore smaller than 1.92

Ask:

- What is the difference between the answers to g), h), and i), - 5.8, 5.80, and 5.800.

Discuss these answers and point out that we can assume that there are zeros at the end after a decimal point so 5.8 = 5.80 = 5.800

Part 3: All three together

Activity - Double zero three and nine

To each group of two or three trainees distribute an envelope containing the activity ***Double Zero Three and Nine - Part 1***.

NAITB, Marr, Anderson & Tout, 1994

Say:

- Take out the cards and find the three cards containing the shaded grids. (Hold up a card containing a grid and show it to the trainees)
- Lay the three grid cards in a row on the table. These cards will be at the head (top) of three columns.
- Pick up another card. Read it and together, place it in the column with the grid that has the same meaning.
- Keep doing this until all the cards have been placed.

Allow time for this to be completed. Check that the cards have been appropriately placed by comparing group responses or alternatively by moving around as they do it and asking trainees to reconsider if you see anything out of place.

Now hand out to each group the second envelope: ***Double zero three and nine - part 2***.

Say:

- This time the cards all have decimal fractions or measurements on them.
- Arrange them into the three groups already in the table.
- Again do them one at a time, as a group.
- Don't worry if there are different numbeers of cards in each column.

Allow plenty of time for the placement of these cards. Again offer assistance when it is needed.

Observing trainees during this activity will help you find out which areas of decimals may need to be revisited.

The quickest way to check their placement would be to give each group a copy of the answer sheet and ask them to check it themselves.

Finish the activity by asking:

- Which did you find the most difficult?
- Is there anything you are still unsure of?

Response to these questions, as well as your own observations, should indicates whether more time needs to be spent on any aspect of this section.

NAITB, Marr, Anderson & Tout, 1994

Activity - Cooperative logic problems

This activity uses a cooperative problem solving structure to reinforce what students have learned about decimals. It encourages them to use the language of number and decimals whilst solving the problems together to find the unknown numbers.

Each person has clues important to the solution of each problem. By combining these clues the group can reach a unique solution.

Presentation

Divide the class into groups. Four is an ideal number.

Say:

- In each envelope there are clues to help your group find a mystery number.
- Each problem is to be solved co-operatively, and you need to work together to find an answer.
- You all have **different** clues, so it is important to listen as each clue is read.
- Your clue should not be **shown** to anyone else - it must always be **read** aloud.

(If any student finds the clues hard to read, help them by reading the sentence over with them before they begin.)

Give each group an envelope of numbers (or digits) - tell them to open it and leave the numbers in the middle of the table to use with all of the four problems.

Then hand to each group, an envelope containing problem ***What is the number? - 1***

Say:

- Open the envelope.
- Share out the clue cards. (Some trainees may receive two cards depending on the size of the group.)
- Take turns to read your clues aloud to the group. (Do not show your clue to anyone else.)
- As you read each clue move the numbers on the table around.

- Keep reading your clues aloud until you all agree that you have an answer.
- Finally, check all your clues again to make sure your answer is OK.
- Ask for the next problem.

Give the problems to the groups one at a time in the order they are numbered (approximate order of difficulty).

Encourage trainees to explain to each other words or ideas that are not understood or remembered. You should intervene only when no-one in the group knows the meaning.

We have included moveable pieces in these problems in order to discourage students from using pencil and paper. When members of a small group start to work out solutions by writing, one person usually dominates, and co-operative problem solving is replaced by individual problem solving.

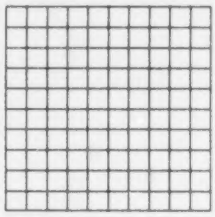
Although answers have been included it should not be necessary to check them or to ask the teacher for correction. The group should be satisfied for themselves that they have met all the conditions. This is the beginning of the notion of self checking which should constantly be reinforced by you as a trainer/teacher, eg. checking subtraction by addition.

Your notes and ideas

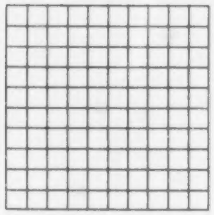
NAITB, Marr, Anderson & Tout, 1994

Looking at hundredths

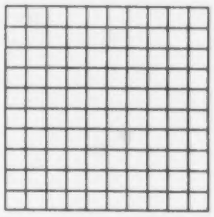
1. Shade the grids



a) 0.78 = $\frac{}{100}$



b) 0.25 = $\frac{}{100}$



c) 0.91 = $\frac{}{100}$

2. Write these decimals as mixed number fractions.

a) 4.32 = 4 $\frac{}{100}$

b) 8.54 =

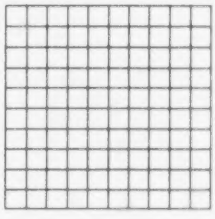
c) 7.43 =

d) 9.77 =

e) two point eight six =

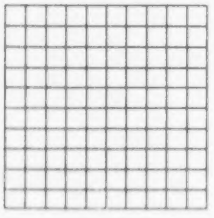
f) three and seventeen hundredths =

3. Shade the grids and fill in the spaces.



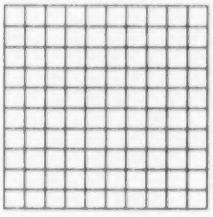
a) 0.03 = $\frac{3}{100}$

= three hundredths



b) 0.09 = $\frac{}{100}$

= _____



c) 0.20 =

= _____

4. Write as mixed number fractions.

a) 2.02 = 2 $\frac{}{100}$

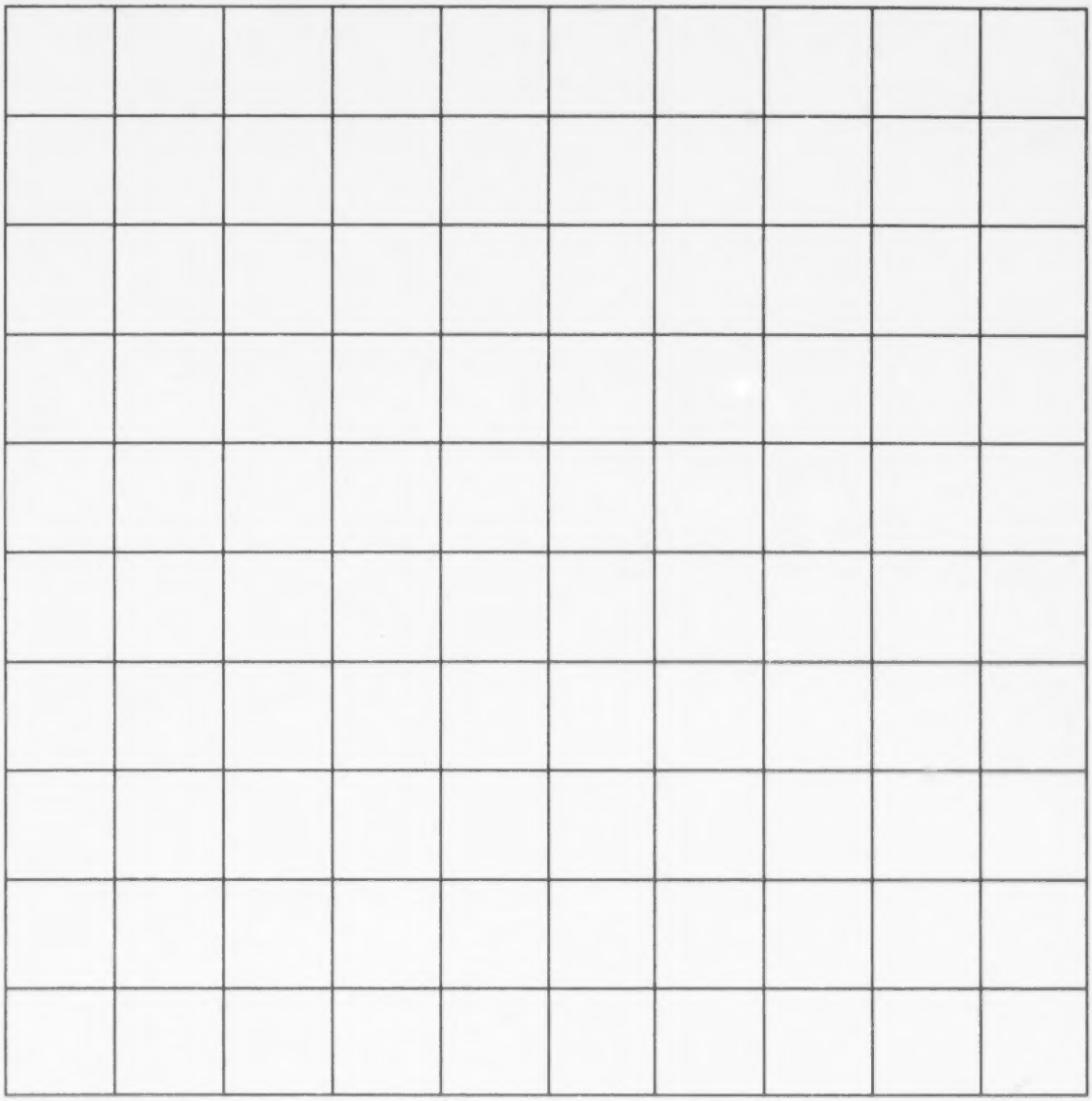
b) 4.06 =

c) 7.08 =

d) 8.30 =

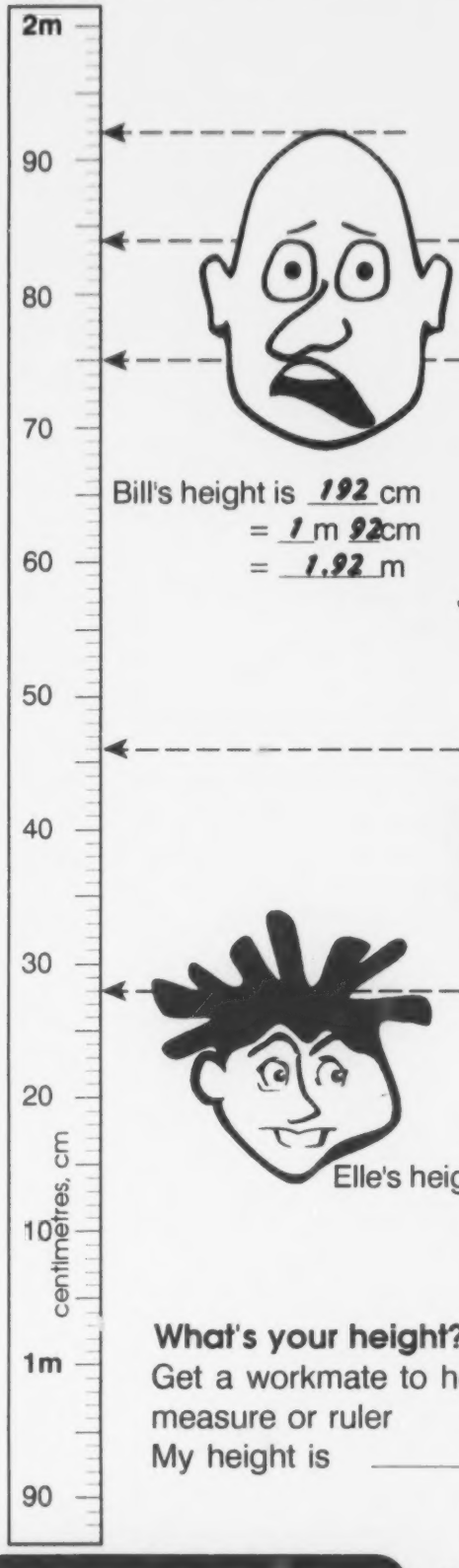
76

Hundredths grid



How tall is 1.92m?

Read the heights of the people below. Write them down in metres (m) and centimetres (cm) as shown.



Bill's height is 192 cm
= 1 m 92 cm
= 1.92 m

Joe's height is _____ cm
= __ m _____ cm
= _____ m

Marco's height is _____ cm
= __ m _____ cm
= _____ m

Mary's height is _____ cm
= __ m _____ cm
= _____ m

Elle's height is _____ cm
= __ m _____ cm
= _____ m

What's your height?

Get a workmate to help you measure your height. Use a tape measure or ruler

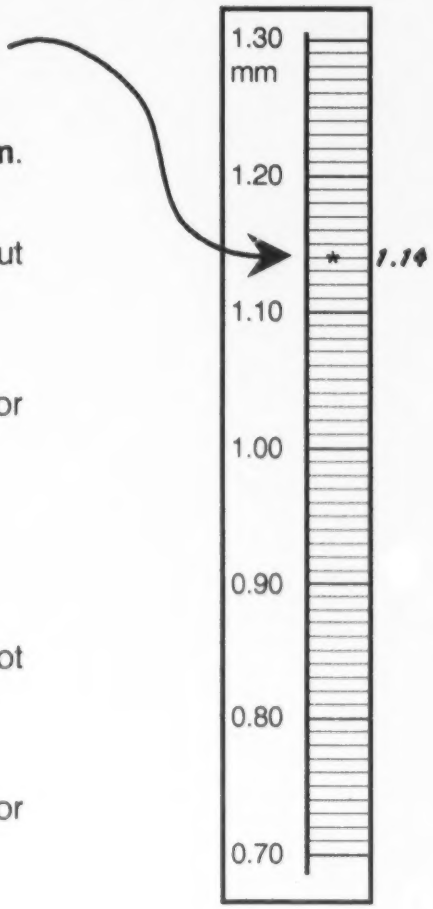
My height is _____ cm = ____ m _____ cm

= _____ m

Paint thickness

This is a section of an SPC Chart for paint thickness.

➤ Use it to plot the facts below.
eg. **1.14mm** is done as an example.



1. The digital readout for hour 1 was **0.90 mm**.
2. At the end of the second hour the readout was **1.20 mm**.
3. Bill called out, "**Zero point eight five**" for Aden to plot for hour 3.
4. Hour 4, **one and eleven hundredths**.
5. Aden shouted "**One exactly**" for Bill to plot for hour 5.
6. "**Point nine four**", called Bill to Aden for hour 6.
7. **One and three hundredths** was the reading for hour 7.
8. "**Oh point seven nine**" said Aden to Bill.

➤ Which of these are outside the range **0.85 - 1.15 mm**?

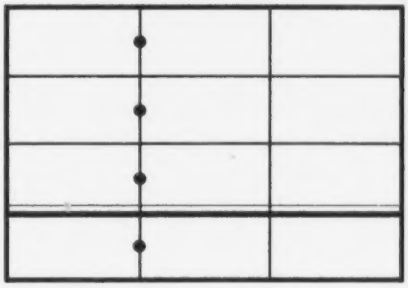
_____

➤ What is the range (the difference between the smallest and largest)?

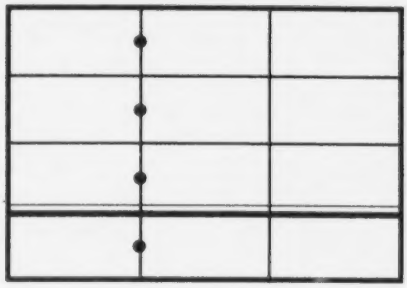
_____

Dicing with decimals - game 3

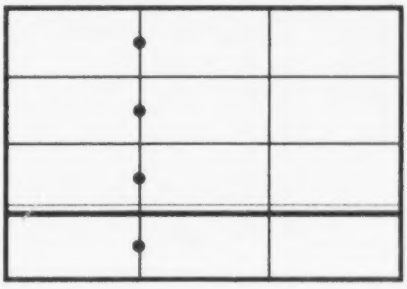
9 throws. Target is 9.99



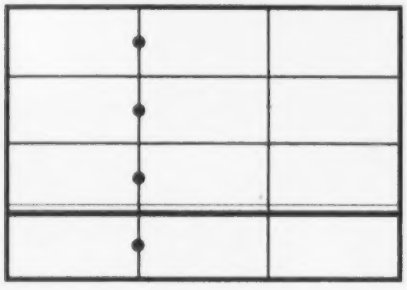
Target: 9.99



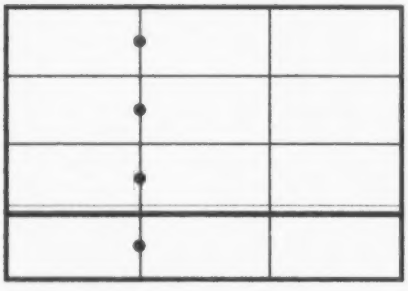
Target: 9.99



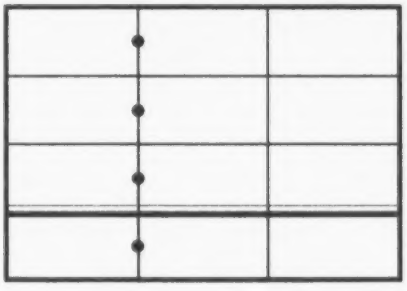
Target: 9.99



Target: 9.99



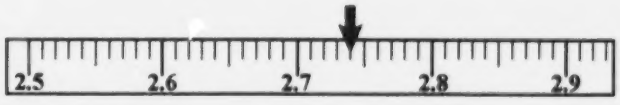
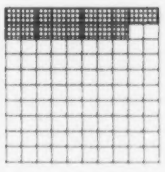
Target: 9.99



Target: 9.99

Hundredths - The Second Decimal Place

1. Draw a line joining up the matching items.

2.74	six and thirty five hundredths
13.9	$6\ ^{59}/_{100}$
6.35	
6.59	thirteen point nine
0.18	1 m 82 cm
6.05	
38.7	six and five hundredths
1.82	

2. Joe was not feeling well and went to the First Aid Centre. Every half hour the nurse took his temperature.

Time	1.00pm	1.30pm	2.00pm	2.30pm
Temperature °C	38.37	38.4	38.29	38.08

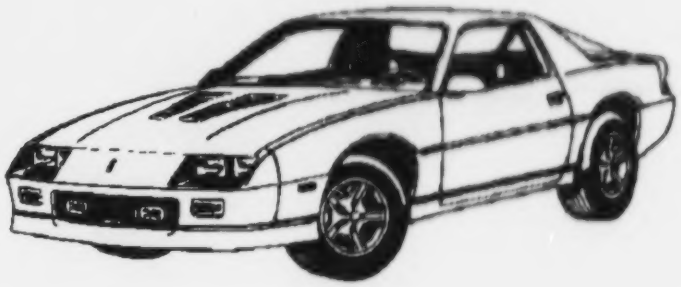
a) When was his temperature the highest? _____

b) Put the temperatures in order.

_____ _____ _____ _____

smallest highest

Data sheet

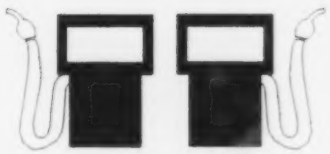


PAINT THICKNESS On a car:

1.07 mm	1.2 mm	1.12 mm	1.1 mm

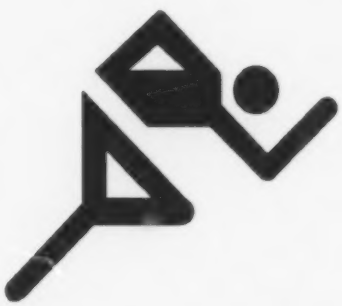
DISTANCES Bill travelled on a full tank of petrol:

388.3 km	379.7 km	401.9 km	385.2 km



TIMES Carl Lewis' last 4 times for the 100m:

9.97 sec	9.86 sec	9.93 sec	9.9 sec



Rounding Off

In groups use the ***Data Sheet*** to answer these questions.

1. Is it O.K. to round off all these measurements to whole numbers? Should some stay as they are?

_____

_____

_____

2. Arrange the data from smallest to biggest.

PAINT THICKNESS: _____ _____ _____ _____
smallest biggest

DISTANCES: _____ _____ _____ _____

TIMES: _____ _____ _____ _____

3. Finish these sentences using words from the box and numbers rounded off - no decimals.

about	***nearly***	***almost***	***approximately***
just over		***just under***	***a bit over***

a. Carl Lewis ran _____ in his last 4 100m races.

b. The paint on our cars is _____.

c. Bill travels _____ on a full tank of petrol.

Reading thousandths

1 a. Draw a line to match the tag (or reading) to the correct number.

b. Write the weight in grams. 1000 grams (g) = 1 kilogram (kg)

Product no.	B2657-54
Weight kg	.078

$1\frac{56}{1000}$ kilograms

= _____ grams

PRICE/kg	USE BY
$ 6.98	16.10.93
1.056	$ 7.37
NET WT kg	TOTAL PRICE

four point one eight three kg

= _____ grams

4.183
weight kg

seventy-eight thousandths of a kilogram

= _____ g

USE BY 22 OCT 93

PRICE/kg	NET WT kg
$ 10.95	0.266

$ 2.91
TOTAL PRICE

$4\frac{831}{1000}$ kilogram

= _____ gram

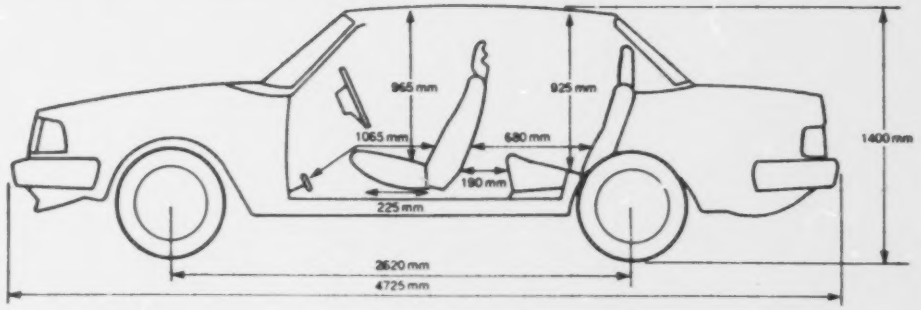
PRICE/kg	USE BY
$ 4.99	01.12.93
4.831	$ 24.11
NET WT kg	TOTAL PRICE

point two six six kg

= 266 g

Reading thousandths

❷ Use the diagram to answer the questions below.



Capacity 2.164 litres
Power 93 kW @ 5,200 rpm
Torque 185 Nm @ 4,400 rpm
0 - 100km/h 12.5 sec
0 - 400m 18.4 sec
60 - 100km/h 8.4 sec
80 - 120km/h 9.8 sec
Stop from 100km/h 52.7 m 76 %g
Overall consumption 9.6 l/100 km
Kerb mass 1,365 kg
Towing 1,100 kg

Eg. a. How long is the car? 4725 mm = 4.725 m

b. How high is the car? _____ mm = _____ m

c. What is the headroom for the front seat? _____ mm = _____ m

d. What is the headroom for the back seat? _____ mm = _____ m

e. What is the wheelbase (the distance between the front and rear wheels)? _____ mm = _____ m

Decimal place value chart

	100's	10's	1's	•	$\frac{1}{10}$ths	$\frac{1}{100}$ths	$\frac{1}{1000}$ths	Number in words
a.			2	•	5			two point five
b.		7	8	•	3	6		seventy-eight and thirty-six hundredths
c.		1	4	•	0	1	2	fourteen and twelve thousandths
d.	3	9	3	•	7			
e.				•				thirty-nine and eight tenths
f.				•				four and fifty-three hundredths
g.			5	•	8			
h.				•				five and eighty hundredths
i.				•				five point eight zero zero
j.	2	4	5	•	7	1		
k.			3	•	0	5		
l.				•				eighteen and two hundredths
m.		9	9	•	1	2	5	
n.				•				twenty-one point zero three four
o.			7	•	0	0	7	
p.			0	•	0	9	5	
q.				•				three and seventy-five thousandths
r.	1	0	7	•	0	1		
s.				•	8	7	0	
t.				•				thirty-nine hundredths
u.				•				sixty point one nine five
v.				•				forty-two and two thousandths

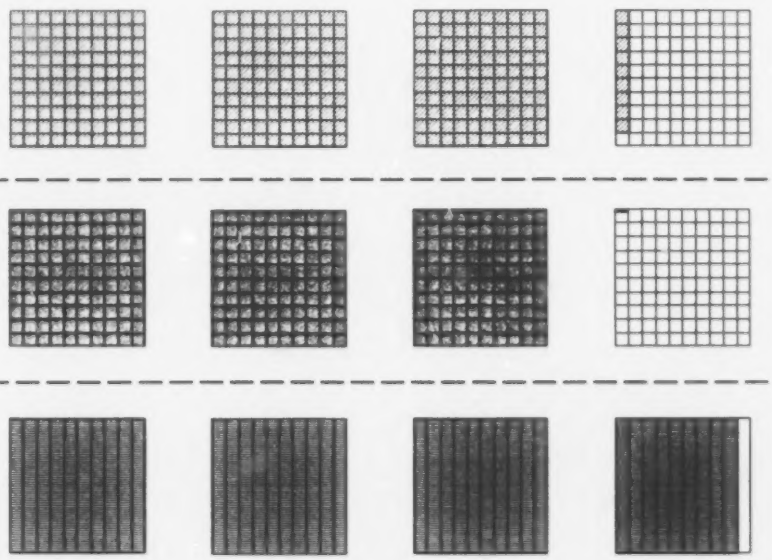
Decimal place value chart

100's	10's	1's	•	$\frac{1}{10}$ths	$\frac{1}{100}$ths	$\frac{1}{1000}$ths	Number in words
			•				
			•				
			•				
			•				
			•				
			•				
			•				
			•				
			•				
			•				
			•				
			•				
			•				
			•				
			•				
			•				
			•				
			•				
			•				
			•				
			•				
			•				
			•				

Double zero three and nine

part 1

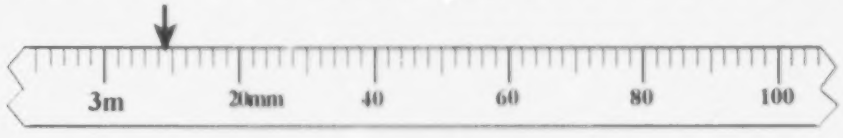
$3\frac{9}{100}$	three and nine hundredths
$3\frac{9}{10}$	three and nine tenths
$3\frac{9}{1000}$	three and nine thousandths

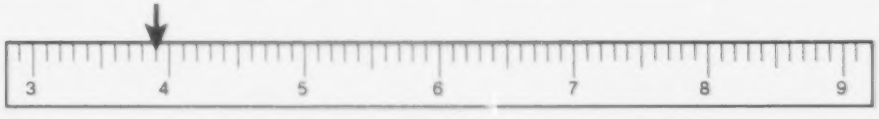


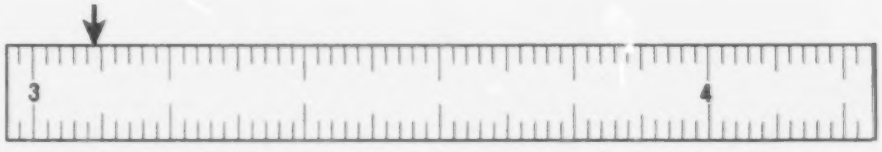
Double zero three and nine

part 2

3.900	three point nine
3.009	three dollars ninety
3.9	three point zero nine
3.09	three dollars and nine cents
3.90	three point zero zero nine
3 kg and 9 g	3 m and 9 mm
	3 m and 9 cm

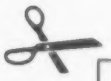






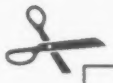
What's the number? - numbers

0	6
1	7
2	8
3	9
4	•
5	



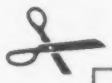
0	6
1	7
2	8
3	9
4	•
5	

What's the number? - 1



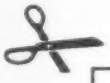
The number is less than 3
There are four digits
The number is just bigger than 2
There is a zero in the number
There are almost 50 thousandths
Two of the digits are 4 and 9

What's the number? - 2



The number is greater than 10
The second digit is twice the first digit
The three digits add up to eleven
The tenths figure is an odd number
The decimal part is a half
The number is less than 100

What's the number? - 3



The number has 3 digits
The number is bigger than five
The number is smaller than 6
The middle digit is 3
The last digit is three times the second digit
All the digits are odd numbers

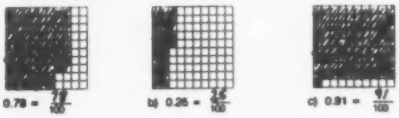
What's the number? - 4

The decimal point is not at the end
Only the digits 1 to 4 are used
There are no thousandths
The digits are in order from small to big
There are more hundredths than tenths
It is a decimal number with four digits

ACTIVITY SHEET

Looking at hundredths

1. Shade the grids



a) 0.78 = $\frac{78}{100}$ b) 0.25 = $\frac{25}{100}$ c) 0.91 = $\frac{91}{100}$

2. Write these decimals as mixed number fractions.

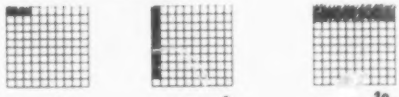
a) 4.32 = $4\frac{32}{100}$ b) 8.54 = $8\frac{54}{100}$

c) 7.43 = $7\frac{43}{100}$ d) 9.77 = $9\frac{77}{100}$

e) two point eight six = $2 \cdot 86 = 2\frac{86}{100}$

f) three and seventeen hundredths = $3\frac{17}{100} = 3 \cdot 17$

3. Shade the grids and fill in the spaces.



a) 0.03 = $\frac{3}{100}$ b) 0.09 = $\frac{9}{100}$ c) 0.20 = $\frac{20}{100}$

= three hundredths = nine hundredths = twenty hundredths

4. Write as mixed number fractions.

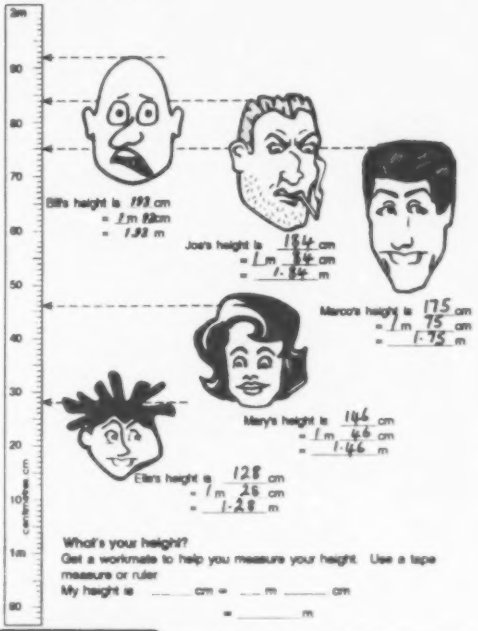
a) 2.02 = $2\frac{2}{100}$ b) 4.06 = $4\frac{6}{100}$

c) 7.09 = $7\frac{9}{100}$ d) 8.30 = $8\frac{30}{100}$

ACTIVITY SHEET

How tall is 1.92m?

Read the heights of the people below. Write them down in metres (m) and centimetres (cm) as shown.



Bill's height is 193 cm = 1 m 93 cm = 1.93 m

Joe's height is 184 cm = 1 m 84 cm = 1.84 m

Marco's height is 175 cm = 1 m 75 cm = 1.75 m

Mary's height is 146 cm = 1 m 46 cm = 1.46 m

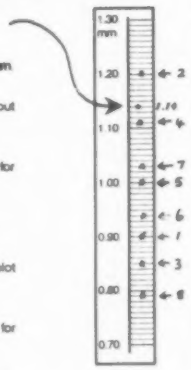
Ella's height is 128 cm = 1 m 28 cm = 1.28 m

What's your height?
Get a workmate to help you measure your height. Use a tape measure or ruler.
My height is ____ cm = ____ m ____ cm
= ____ m

PRACTICE SHEET

Paint thickness

This is a section of an SPC Chart for paint thickness.



➤ Use it to plot the facts below eg. 1.14mm is done as an example.

1. The digital readout for hour 1 was 0.90 mm.
2. At the end of the second hour the readout was 1.20 mm.
3. Bill called out, "Zero point eight five" for Aden to plot for hour 3.
4. Hour 4, one and eleven hundredths.
5. Aden shouted "One exactly" for Bill to plot for hour 5.
6. "Point nine four", called Bill to Aden for hour 6.
7. One and three hundredths was the reading for hour 7.
8. "Oh point seven nine" said Aden to Bill.

➤ Which of these are outside the range 0.85 - 1.15 mm?

2 and 8

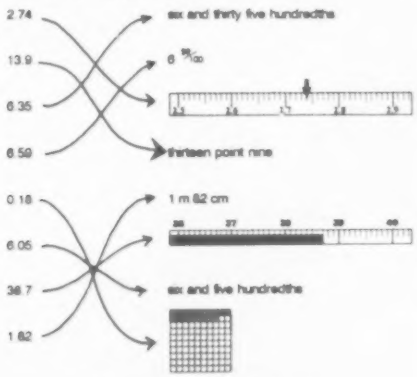
➤ What is the range (the difference between the smallest and largest)?

1.20 − 0.79 = 0.41 mm

PRACTICE SHEET

Hundredths - The Second Decimal Place

1. Draw a line joining up the matching items.



2. Joe was not feeling well and went to the First Aid Centre. Every half hour the nurse took his temperature.

Time	1.00pm	1.30pm	2.00pm	2.30pm
Temperature °C	38.37	38.4	38.29	38.08

a) When was his temperature the highest? 1.30 pm.

b) Put the temperatures in order.

38.08 38.29 38.37 38.4

smallest highest

BEST COPY AVAILABLE

ACTIVITY SHEET

Rounding Off

In groups use the **Data Sheet** to answer these questions.

1 Is it O.K. to round off all these measurements to whole numbers? Should some stay as they are?

Paint thickness depends on the purpose.
Distances definitely OK to round off.
Race times should stay as they are.

2 Arrange the data from smallest to biggest.

PAINT THICKNESS:	1.07 (smallest)	1.1	1.12	1.2 (biggest)
DISTANCES:	379.7	385.2	388.3	401.9
TIMES:	9.86	9.9	9.93	9.97

3 Finish these sentences using words from the box and numbers rounded off - no decimals.

about	nearly	almost	approximately
just over	just under	a bit over	

a. Carl Lewis ran (many choices) 10 sec. in his last 4 100m races.

b. The paint on our cars is (many choices) 1 mm thick.

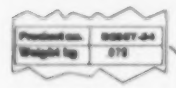
c. Bill travels (many choices) 400 km on a full tank of petrol.

PRACTICE SHEET

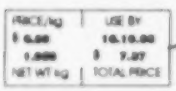
Reading thousandths

Page 1

a. Draw a line to match the tag (or reading) to the correct number.
b. Write the weight in grams. 1000 grams (g) = 1 kilogram (kg)

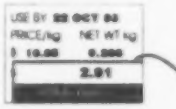


1.056 kilograms = 1056 grams

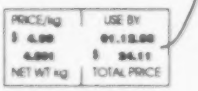


four point one eight three kg = 4183 grams

seventy-eight thousandths of a kilogram = 78 g



4.931 kilogram = 4931 gram



point two six six kg = 266 g

Reading thousandths - page 2

② b. 1400 mm = 1.4 m

c. 965 mm = 0.965 m

d. 925 mm = 0.925 m

e. 2620 mm = 2.62 m

PRACTICE SHEET

Decimal place value chart

	100s	10s	1s	.	1/10ths	1/100ths	1/1000ths	Number in words
a.			2	•	5			two point five
b.		7	8	•	3	6		seventy-eight and thirty-six hundredths
c.		1	4	•	0	1	2	fourteen and twelve thousandths
d.	3	9	3	•	7			three hundred and ninety-three point seven, or three hundred and ninety-three and seven tenths
e.		3	9	•	8			thirty-nine and eight tenths
f.			4	•	5	3		four and fifty-three hundredths
g.			5	•	8			five point eight, or five and eight tenths
h.			5	•	8	0		five and eighty hundredths
i.			5	•	8	0	0	five point eight zero zero
j.	2	4	5	•	7	1		two hundred and forty-five point seven one, or two hundred and forty-five and seventy-one hundredths
k.			3	•	0	8		three point zero five, or three and five hundredths
l.		1	8	•	0	2		eighteen and two hundredths
m.		9	9	•	1	2	5	ninety-nine and one hundred and twenty-five thousandths, or 99 point one two five
n.		2	1	•	0	3	4	twenty-one point zero three four
o.			7	•	0	0	7	seven point two zero seven, or seven and seven thousandths
p.			0	•	0	9	5	ninety-five thousandths, or zero point zero nine five
q.			3	•	0	7	5	three and seventy-five thousandths
r.	1	0	7	•	0	1		one hundred and seven point zero one, or one hundred and seven and one hundredth
s.				•	8	7	0	point eight seven zero, or eight hundred and seventy thousandths
t.				•	3	9		thirty-nine hundredths
u.		6	0	•	1	9	5	sixty point one nine five
v.		4	2	•	0	0	2	forty-two and two thousandths

BEST COPY AVAILABLE

Double zero three and nine

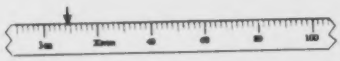
$3\frac{9}{1000}$ three and nine thousandths

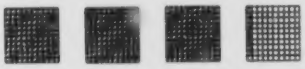
three point zero zero nine

3.009

3 kg and 9 g

3 m and 9 mm





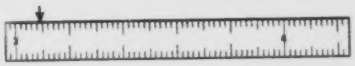
$3\frac{9}{100}$ three and nine hundredths

three point zero nine

3.09

three dollars and nine cents

3 m and 9 cm

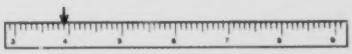


$3\frac{9}{10}$ three and nine tenths

three point nine

3.9 3.90 3.900

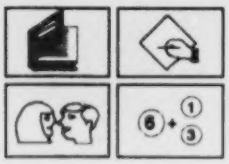
three dollars ninety



What's the number?

1. 2.049
2. 12.34
3. 5.39
4. 24.5

Percentages of your life



NATIONAL AUTOMOTIVE
LANGUAGE & LITERACY
COORDINATION UNIT

Percentages of your life

Purpose

The idea of percentage pervades every workplace. % is one of the most commonly seen symbols when workplace figures are recorded or presented. It is used to describe market shares, quality of production, rates of attendance, wage rises and deductions, and countless other statistics. Percentages are used repeatedly in workplace charts and tables designed to motivate workers to greater productivity and company involvement.

It is important therefore that workers have a clear idea of what percentages are telling them and how to calculate with them with understanding.

NAITB, Marr, Anderson & Tout, 1994

Background

The activity begins with familiar things that your trainees will probably have heard of through work, the union, banking, and shopping. Most have been in the news quite often.

Beginning maths ideas with things people know about, makes them feel comfortable and confident to go on. This activity combines the idea or concept of percentage with a chance for people to share what they know about and express their opinions on some issues which affect them as well.

The first part of this activity is done in small groups. There are many reasons for this:

- it involves people actively at the beginning of the session rather than the trainer doing most of the talking;
- it is less threatening for most people than starting off alone;
- talking and discussing are effective ways of learning
- there is a chance for the class members to share what they know witheach other;
- people in the class who may not know something will not feel stupid or left out;
- it gives the trainer a chance to find out what people know, early in the session, rather than assuming they know nothing.

What to prepare

Photocopy pages 10 and 11, one set for each group of four trainees in your class (best on coloured cardboard if you have some). Cut out the shapes and store each set in labelled envelopes ① and ② as follows. In each envelope number ① there should be:

- 7 different short statements (eg. A Wage Rise);
- 7 different percentage squares (eg. 4%); and
- 7 different complete sentences (eg. for every $100 you earn you will get an extra four dollars).

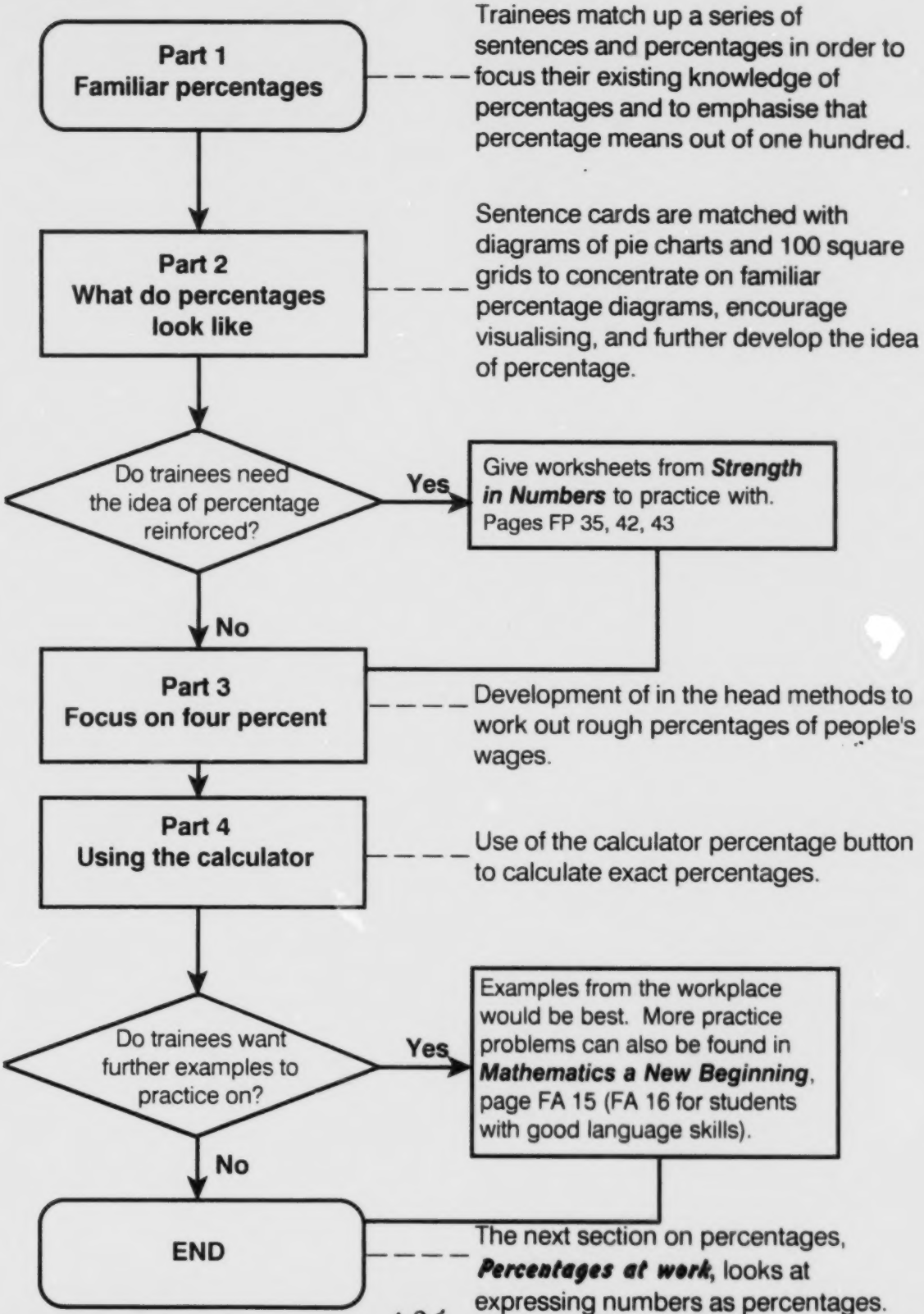
In each envelope ② there should be the set of cut out diagram cards (page 12).

For each trainee you will need to make:

- a photocopy of the following sheets
  - ❑ ***Summary sheets***
  - ❑ ***People and their jobs***
  - ❑ ***People and their jobs - sheets 1 & 2***
  - ❑ ***Calculators***

NAITB, Marr, Anderson & Tout, 1994

Outline of section


Part 1
Familiar percentages
Trainees match up a series of sentences and percentages in order to focus their existing knowledge of percentages and to emphasise that percentage means out of one hundred.
Part 2
What do percentages look like
Sentence cards are matched with diagrams of pie charts and 100 square grids to concentrate on familiar percentage diagrams, encourage visualising, and further develop the idea of percentage.
Do trainees need the idea of percentage reinforced?
Yes
Give worksheets from Strength in Numbers to practice with. Pages FP 35, 42, 43
No
Part 3
Focus on four percent
Development of in the head methods to work out rough percentages of people's wages.
Part 4
Using the calculator
Use of the calculator percentage button to calculate exact percentages.
Do trainees want further examples to practice on?
Yes
Examples from the workplace would be best. More practice problems can also be found in Mathematics a New Beginning, page FA 15 (FA 16 for students with good language skills).
No
END
The next section on percentages, Percentages at work, looks at expressing numbers as percentages.

NAITB, Marr, Anderson & Tout, 1994

Part 1: Familiar percentages

Presentation

Arrange trainees into working groups of four at the beginning of the session - grouped around the tables is best - not in a line.

Ask each group to empty their envelopes and match each short statement with the most likely percentage square, and the most appropriate sentence. Hold up one of each to make it clear to the group.

Walk around among the groups to encourage argument and discussion.

When they have finished, ask one group to give their solutions and check that the others agree. Any disagreements should be discussed by the whole class.

Some answers might be open to argument because they change over time or in different companies. This does not matter! It encourages thinking, discussion and comparison. The group could vote on the correct answer or come back next week with accurate figures to settle any dispute.

To make sure that the relevence of 100 is discussed, get class members to read out one or two of the sentences and ask why the 100 is in them. eg. A Wage Rise, Holiday loading.

Statements which are likely to provoke useful discussion are:

- ***100% - Pure New Wool - Completely one thing*** -trio. Remember the main point is 100% means the lot or the whole thing. You could compare this with similar common labels such as 100% cotton, 100% pure fruit juice, all of which mean the whole lot, pure, complete.

  Ask trainees to think of other expressions which use 100% and analyse their meaning.

- ***150% - Time and a half*** - $12 becomes $18. People can be confused by a percentage which means more than a whole - the emphasis is on getting all you have already (100%) and then an extra 50% as well. The diagrams of the next part may help.

NAITB, Marr, Anderson & Tout, 1994

- ***.05% - Blood Alcohol Content*** - may also confuse if people try to look at its true meaning. (It really means that in every litre (1000 ml) of blood there is half a millilitre of alcohol.) Much less than 1 in every 100 or 1%

The main feature is that 1% is 1 out of 100. .05% is .05, or 5 hundredths out of 100 which is much smaller than 1 %.

It would be better to talk about the .05% and 150% when you have the diagrams in front of the groups. Another percentage to mention is the Medicare Levy which has risen from 1.25% to 1.4%.

Part 2: What do percentages look like?

Activity

With the pieces still laid out in front of the groups, give out envelope ② - percentage diagrams.

Presentation

Ask the groups to match up as many of these pictures as possible with the percentage groups in front of them.

Warn them that not all diagrams will match up.

Allow time for discussion.

When groups have matched all possible diagrams, check that they all agree and then ask the following questions:

- Were there any diagrams which were tricky to match up? Why?
- Look at the diagrams which do not match up and see if you can decide what percentages they are.

The .05% diagram is hard to visualise because it is so much smaller than 1% It is in fact 5/100 or 5 hundreths of 1%.

Hopefully the sharing of thoughts within the group will mean you do not have to explain too much. However it would be good to summarise **quickly** the main percentages (25%, 50%, 75%, 100%). You can use the $\frac{1}{3}$ picture to introduce briefly the idea that $\frac{1}{3}$ of 100 is $33\frac{1}{3}\%$ or 33.33%

Part 3: Focus on four percent

Activity

Get groups to put away all cards except the 4% pay rise set. With trainees still sitting and discussing in small groups, pose the next question and advise them to use the cards in front of them to get a rough answer.

Ask:

- If you got a 4% pay rise tomorrow, approximately how much would you get?

As the groups are discussing - walk around and listen to how much they are able to work out for themselves.

Optional questions:

Put these questions to small groups who are having trouble getting started.

- The sentence on the card here says: "For every $100 you earn you get extra $4. So if you get $100 a week now, what would your rise be?"
- If you get $200 a week now, what would your rise be?
- How many hundreds of dollars do you earn each week - roughly?
- Do you earn closer to 300 or 400 dollars each week: So about how many extra $4 dollar bits would you get?

Give groups a chance to discuss thoroughly.

Summarise with the whole group:

4% of $100 is 1 x $4 or $4
4% of $200 is 2 x $4 or $8
4% of $300 is 3 x $4 or $12

Ask:

- If you were an executive manager who gets $900 per week, what would the rise be?
- What did you do to work that out?
- Is there a pattern or rule?

Try to get trainees to say this in their own words. Ask questions to help them explain their methods until everyone feels confident.

NAITB, Marr, Anderson & Tout, 1994

Activity - People and their jobs

Use the sheet of ***People and their jobs*** to allow the class to practice this technique until they are confident. Make up questions as you go, such as:

- 5% of the cleaner's weekly salary
- 3% of the accountant's weekly salary
- 10% of the teachers weekly salary.

Remember this activity is about short cuts - in the head methods. If writing is needed it should just be jotted down numbers not a formal calculation or sum. The main things to concentrate on are:

How many hundreds is it closest to?
How many in each hundred?

Agreement among the group is usually a good check of correct answers but if in doubt use a calculator to check (see next section for the method.) Use the Practice sheet ***Sheet 1 - People and their jobs*** to reinforce and practice these skills.

When students are dealing easily with 300, 400, 900, try the annual salaries from ***People and their jobs***, with questions like:

- What is a 4% pay rise?
- What is a 6% pay rise?

eg. ***$30,000 - find 4%***
30 000 is 300 hundreds
so we want 300 lots of $4
300 x $4 = $1200

The thought process is again, how many hundreds? So remove the comma and separate, or cross off the last two zeros 300 00 showing clearly three hundred, hundreds.

Use the Practice sheet ***Sheet 2 - People and their jobs*** to reinforce and practice skills with larger amounts.

Activity - Percentage discounts

Another short cut method for finding percentages is the "cents in the dollar" method. In this case the percentage matches the number of cents in each dollar.

e.g. ***4% means 4 cents in each dollar***
10% means 10 cents in each dollar, etc

Give an example:

a discount of 4% off an item costing $20 is:
4% means 4 cents in each dollar
so 4c x 20 = 80c discount.

To practice this "cents in the dollar" method hand out the Practice sheet ***Percentage discounts***.

NAITB, Marr, Anderson & Tout, 1994

Part 4: Using the calculator

Presentation

Suggest to the class that sometimes you need to be able to check figures like this exactly. For instance, to make sure the pay office has got it right on your cheque after a 4% pay rise.

The quickest, easiest and most accurate way is with a calculator.

Ask:

- How would you go about calculating exactly 4% of $465 on a calculator?

Give out sets of calculators and allow a few minutes for people to try out ideas.

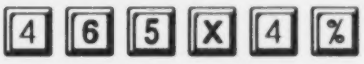
For exact work a calculator is usually used.

There are many ways to calculate percentages using a calculator.

The % button is just one simple method which all can use. But most adults are curious about its use.

Briefly acknowledge any ideas which lead to correct answers but go on to highlight the particular use of the % button.

On the board write this sequence of buttons for students to follow:



Discuss whether or not the = needs to be pressed.

= May be optional for some calculators.

Try out a few problems together such as:

- What would be a 12% discount on a $635 video?

  Answer: $76.20

- What would be a 15% tax on a $130 food bill?

  Answer: $19.50

- What would be a 1.4% Medibank levy on a salary of $32,650?

  Answer: $457.10

- What would be time and a half on an hourly pay rate of $18.62?

  Answer: $27.93

NAITB, Marr, Anderson & Tout, 1994

Possible questions:

- How much would you trust the calculator?
- What happens if you press the wrong button?
- How could you check your answer?

Sensible use of a calculator always includes a rough estimate to ensure you have not hit a wrong button resulting in a nonsense answer.

Briefly discuss how previous methods of rough calculation should be used in conjunction with calculator methods.

For example with the video,

$635 is close to $600
$600 is 6 hundreds
12% is 6 x $12 or $72.

The calculator gave $76.20. Our rough estimate tells us the decimal point is in the right place and the answer is reasonable.

Give out the ***Calculators*** Practice Sheets which will provide some examples for them to take away and practise to be sure they can remember it all in a few days.

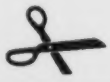
Your notes and ideas

NAITB, Marr, Anderson & Tout, 1994

Percentages of your life

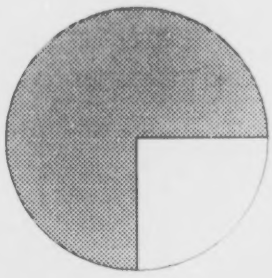
A Wage Rise	150%
Blood Alcohol Content (BAC)	100%
A Home Loan Interest Rate	4%
Holiday Loading	9.8%
Time and a Half Overtime Rate	.05%
Pure New Wool	17.5%
Half Price Sale	50%

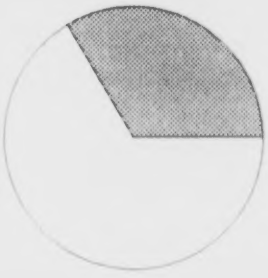
Percentages of your life

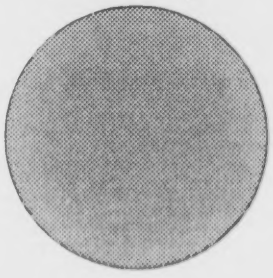


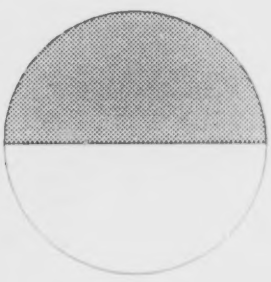
An extra $17.50 for each $100 of your wage to make up for loss of overtime
For every $100 you earn you will get an extra four dollars.
A pay rate of $12 per hour becomes $18 per hour.
A product normally costs $60 but now costs only $30.
For every year of the loan you have to pay almost $10 interest for each $100 borrowed.
A percentage much lower than 1%
Completely one thing.

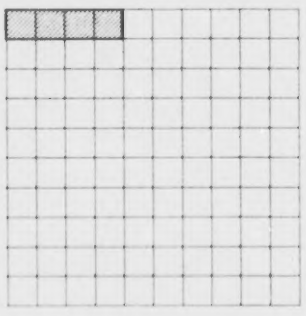
Percentages of your life

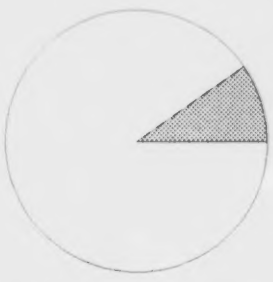


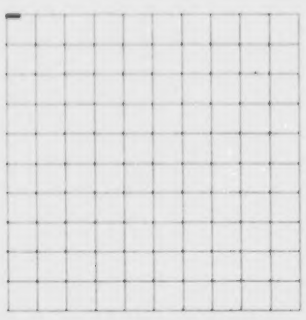


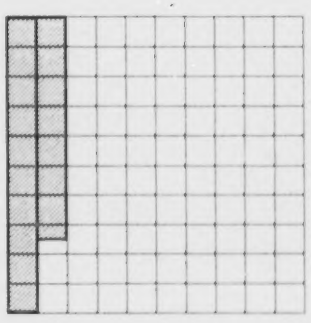












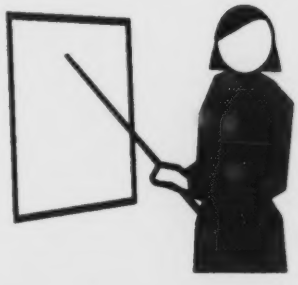
People and their jobs

Bill, the car mechanic, earns $24,700 a year which is about $475 each week.

Tibor, the doctor earns $57,200 per year which is about $1,100 a week.

Sophie, the cleaner, earns about $400 each week which is about $21,000 over a year.

Mary, the accountant earns $36,400 annually which is about $700 per week.



Fran, the teacher, earns $41,000 a year which is about $790 a week.

Jake, the carpenter, earns around $550 each week which is about $28,600 for a year.

People and their jobs - Sheet 1

Using the Activity sheet ***People and their jobs*** estimate answers to these questions.

① Bill, the car mechanic, gets a **4%** pay rise. Roughly, how much more will he earn each week?

② Jake, the carpenter, saves about **10%** of his salary each week for a holiday. About how much is this each week?

③ **7%** of Tibor's weekly income pays for cleaning. Approximately, how much does it cost him?

④ Each week **12%** of Tran's pay is spent on child care. About how much is this?

⑤ Sophie spends **7.5%** of her weekly earnings on petrol. How much does she pay for petrol each week?

People and their jobs - Sheet 2

Using the Activity Sheet ***People and Their Jobs*** estimate answers for these questions.

①About **2%** of a doctor's annual earnings pays for membership fees. How much would Tibor spend each year on memberships?

②**3%** of Tran's annual salary is paid to her superannuation fund. How much approximately, is this each year?

③In Mary's firm, the accountants receive a **5%** allowance for travelling. About how much is this for Mary each year?

④Jake uses about **6%** of his annual pay to buy tools. What amount of money is this roughly?

⑤For which of the six people is a flat rate pay rise of $10 per week better than a **2%** pay rise?

Percentage discounts

❶ What would a **5%** discount be for:

E.g. The soccer ball? ***5% means 5 cents in each dollar***
→ 5c x 29 = 145c = $1.45 discount.

The hammer? _____

_____

❷ What would a **12%** discount be for:

The folder? _____

_____

The hammer? _____

_____

❸ What would a **30%** discount be for:

The hammer? _____

_____

The soccer ball? _____

_____

Calculators

Use the [%] on your calculator to answer these.

≈ **Approximate** - do an answer without a calculator to make sure your answers are sensible.

1. A bed priced at $575 is discounted by 12%. What is the discount?

≈ **approximate:**

575 nearly 600
6 hundreds
12% = 6 x $12 = $72

exact answer from calculator:

[5] [7] [5] [X] [1] [2] [%] 69.

$69.00

2. A refrigerator is advertised at $788. You have a 15 % discount offer. How much will you save?

≈ **approximate:**

exact answer from calculator:

_____

3. Mina pays about $180 for petrol each month. If there was an extra 2% tax on petrol. How much would it cost?

≈ **approximate:**

exact answer from calculator:

_____

Calculators - p. 2

4. A car plant makes a weekly average of 920 cars. This week production was about 3% above average. How many more did they make this week?

≈ approximate:

exact answer: _____

sensible answer: _____

5. There are 645 workers in a company. 7% were away on Tuesday. How many were not there? How many were at work?

≈ approximate:

exact answer _____

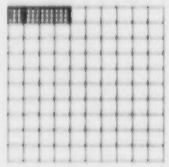
sensible answer _____

at work: _____

PERCENTAGES ❶

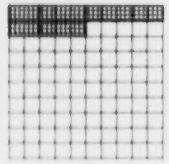
Percentages can be expressed in many ways.
Some examples are:

- ***4% wage rise***

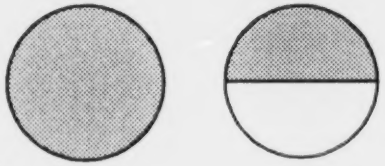


for every $100 you earn you will get an extra $4

- ***15% discount***
  - 15 cents off every $1

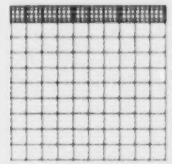


- ***150% - time and a half overtime***

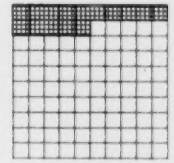


$12 per hour rises to $18 per hour.

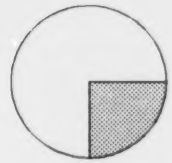
What do some common percentages look like?



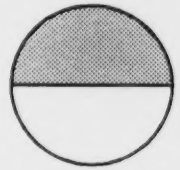
10%



15%



25%



50%

75%

100%

PERCENTAGES ❷

A 4% pay rise.

- ***A 4% pay rise on a pay of $500 per week.***

  4% means you get **$4 extra for every $100**

  $500 per week → 5 lots of $100

  5 lots of $4 is $20, — rise is **$20 per week**

- ***A 4% pay rise on a salary of $20,000 a year.***

  $20,000 a year → 200 lots of $100

  So the **rise** is 200 lots of $4 which **is $800**.

- Using your **calculator** :
  To work out a **6%** pay rise if you earn **$515** per week press:

  5 1 5 X 6 % → 30.9

  So the pay rise is **$30.90** per week.

A 15% discount.

- ***A 15% discount on a shirt marked $20.***

  15% discount means **15 cents off every dollar.**

  $20 shirt → 20 dollars

  So 20 lots of 15c is 20 x 15cents = 300 cents

  So the discount is **$3**.

- A **15% discount** off a TV marked at **$400**.

  15% discount means **$15 off every $100**

  $400 TV → 4 lots of $100

  So the discount is 4 lots of $15 — **$60**.

- Using your **calculator** :
  To work out a **15% discount** on a **$690** fridge, press:

  6 9 5 X 1 5 % → 104.25

  So the discount is **$104.25.**

People and their jobs - sheet 1

1. Roughly $20
2. About $55
3. Approximately $77
4. About $95
5. $30

People and their jobs - sheet 2

1. About $1140, $1144 or $1200 are all ok.
2. Approximately $1230.
3. About $1800, $1820 or $2000 are ok.
4. Roughly, $1716 or $1800
5. Sophie and Bill would be better off with the flat rate pay rise of $10 per week.

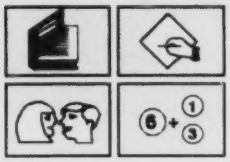
Percentage discounts

1. 60 cents
2. 48 cents, $1.44
3. $3.60, $8.70

Calculators

1. $69
2. $118.2
3. $3.60
4. Exact answer 27.6
   Sensible answer 28
5. Away: exact answer 45.15
   Sensible answer 45
   At work 6.00

Percentages at work



NATIONAL AUTOMOTIVE
LANGUAGE & LITERACY
COORDINATION UNIT

Percentages at work

Purpose

Part 1 of this activity is to reinforce the trainees' understanding of the concept of percentages. Part 2 is to help trainees develop shortcuts for calculating percentages from quantities such as 6 out of 200, 12 out of 300 etc. It uses hands on material that should allow trainees to develop their own "in the head" methods for these calculations.

Part 3 is similar to Part 2, but is for quantities such as 6 out of 50, 6 out of 20 etc.

Part 4 concentrates on how to calculate percentages (that are less obvious) from quantities such as 14 out of 450, 62 out of 80 and 37 out of 40, using calculators.

NAITB, Marr, Anderson & Tout, 1994

Background

In this session we have encouraged the use of **hands-on materials:** the cut out pieces and grids used to clarify percentage calculations. Workplace trainers will know that in the factory, hands on experience, or doing it yourself, is basic to all training and learning. The learning of mathematics is no different. Using hands-on materials in teaching maths to adults encourages visualisation and understanding of ideas and mathematical rules.

By manipulating concrete objects, students learn by exploration and discovery, and become active in their own learning. This seems the best way to distance students from the realms of the 'mystifying magic tricks' that maths teachers displayed to them when they were at school.

Teachers who try the hands-on approach with adults, have consistently been rewarded with cries of "I see", "Now it makes sense" or "Why didn't they do it this way at school?" So the effort of cutting out the bits and pieces is worthwhile and important.

Another advantage of hands-on materials is that students can return to them confidently if they forget the process or the rule, or if they wish to check their reasoning.

Many teachers and trainers involved in adult education were the victims of similar educational methods as their students. Having learnt maths using traditional paper and pencil methods they may not feel very confident with alternative approaches. Trainers using hands-on materials for the first time may also fear the reaction from trainees when they produce materials which they may think belong in kindergarten or primary school! But it is important to overcome these initial reservations. Once you have used them and seen how effective they are, hands-on materials will become a valuable part of your training.

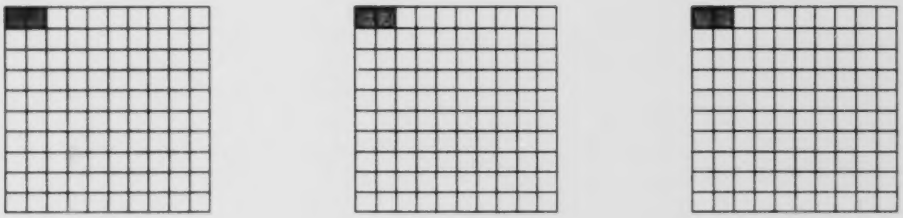
NAITB, Marr, Anderson & Tout, 1994

Note - Using grids

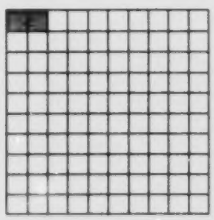
The grids are used to allow trainees to see how quantities such as 6 out of 200, 6 out of 25 can be related to 'out of 100'. From previous work, (see ***Percentages of your life*** activity) the trainees should know that 2 out of 100 is 2%.

For example, for **6** out of **300**, the 6 have to be spread evenly over the 100 Grid Sheets.

6 out of **300** looks like:



This hands on approach should help trainees see that **6** out of **300** is the same as **2** out of **100,** which is **2%**



What to prepare

For each trainee you need a copy of:

- ❑ ***Defective parts***
- ❑ ***Percentage attendance***
- ❑ ***Working percentages***
- ❑ ***Percentages - major facts***

For each group of 2 or 3 trainees you will need an envelope or a plastic bag containing:

- ♦ Three 100 Grid Sheets
- ♦ Two 50 Grid Sheets
- ♦ Four 25 Grid Sheets
- ♦ A set of small square pieces

NAITB, Marr, Anderson & Tout, 1994

Photocopy the Grid Sheets onto light coloured cardboard.

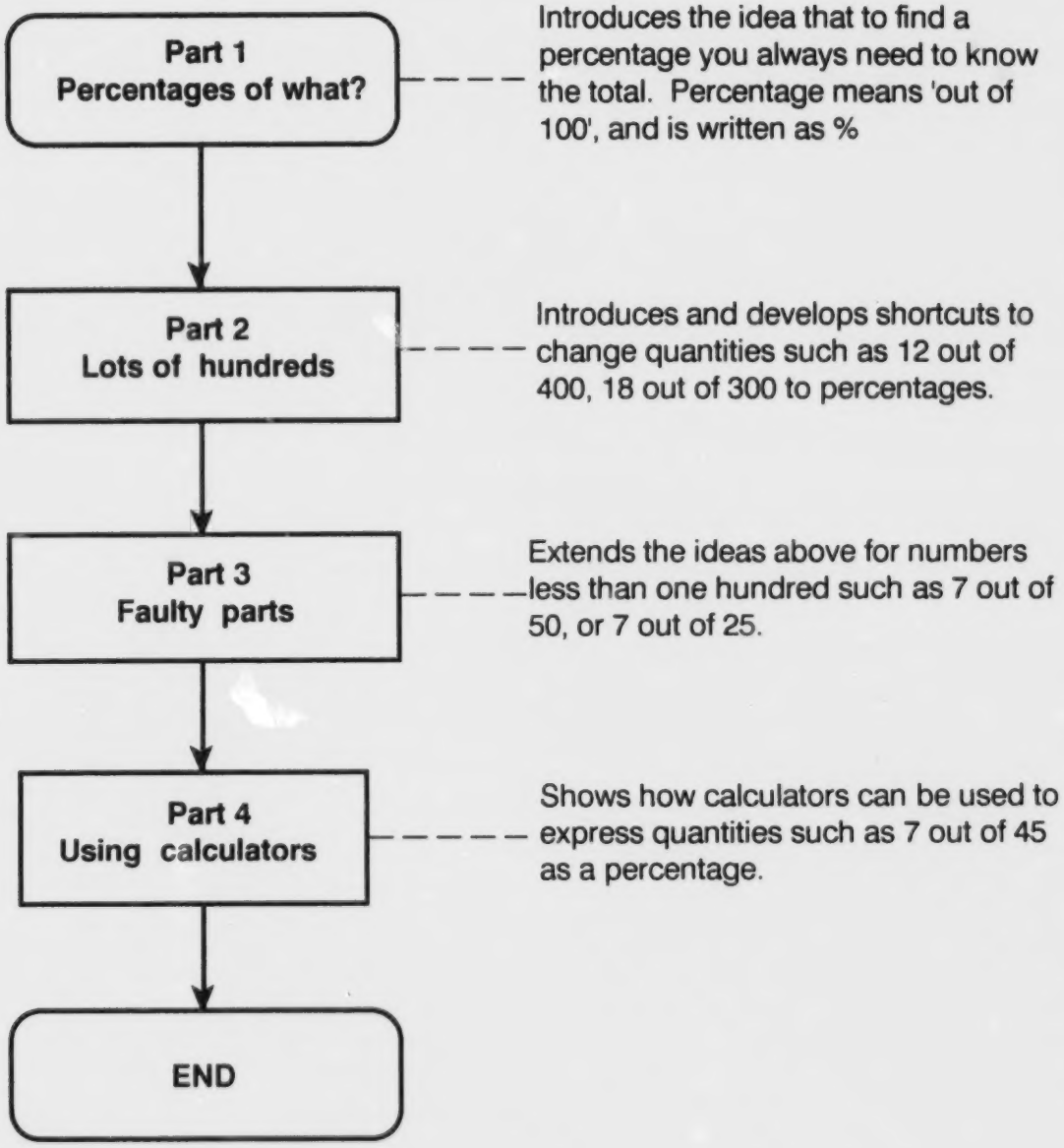
Photocopy the small square pieces onto dark coloured cardboard.

To make the 25 and 50 Grid Sheets photocopy the ***Hundred grid*** (p. 16) onto light coloured cardboard. Then cut the sheet into four 25 Grid Sheets or two 50 Grid Sheets.

To make the small square pieces photocopy the ***Hundred grid*** sheet onto dark coloured cardboard. Then cut these into individual squares. One or two sheets cut up into squares will provide plenty of these pieces.

NAITB, Marr, Anderson & Tout, 1994

Outline of section


Part 1
Percentages of what?
Introduces the idea that to find a percentage you always need to know the total. Percentage means 'out of 100', and is written as %
Part 2
Lots of hundreds
Introduces and develops shortcuts to change quantities such as 12 out of 400, 18 out of 300 to percentages.
Part 3
Faulty parts
Extends the ideas above for numbers less than one hundred such as 7 out of 50, or 7 out of 25.
Part 4
Using calculators
Shows how calculators can be used to express quantities such as 7 out of 45 as a percentage.
END

NAITB, Marr, Anderson & Tout, 1994

Part 1: Percentages of what?

Presentation

Put this question to the group.

Note: If you have not used the grids please see: *Note on Using Grids*

Six people ring in to say they are sick, so they will be absent. What percentage of workers are away sick?

Possible questions:

- Can anyone tell me the answer?
- Is it possible to answer this?
- Is there enough information?
- What do we need to know?
- What is percent?
- Are the six from this section? plant? company?

This questions cannot be answered without further information . It is like asking "how long is a piece of string?"

To find out the percentage, we need to know the total number of people employed in the section, plant, or company.

Now take this further by supplying some necessary information.

Presentation

Ask:

- Suppose the six are from a plant that employs 100 people, what percentage are away?

Discuss this question long enough to remind trainees of the meaning of percent.

The emphasis should be 6% means 6 out of 100

Ask:

- What other ways can we write or say this?

Possible responses could be recorded such as:

6 out of 100
6 in every 100
6 per 100
6%
6 over 100 or $\frac{6}{100}$

128

Distribute the envelopes containing the grid sheets and get the class to model this 6 percent using the 100 grid sheets.

NAITB, Marr, Anderson & Tout, 1994

Part 2: Lots of hundreds

Presentation

Say:

- Suppose the six are from a plant that employs 200 people.

Ask:

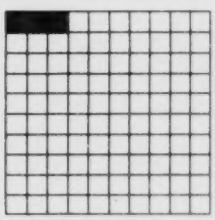
- Will this give a different percentage?
- What is it?

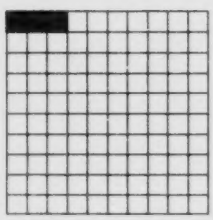
Get the trainees in groups to share the grids, and model this situation. This will make sure they have a real picture before starting to do calculations.

They will have to put two grids together like this:

eg. 6 out 200 is the same as

The six have to be spread evenly over the two 100 grids (for 200) or three 100 grids (for 300)





Ask:

- How many squares are covered on each grid?

Say:

- Suppose the 6 are from a plant of 300.

6 out of 200 is the same as 3 out of 100
6 out of 300 is the same as 2 out of 100

Repeat the steps above to demonstrate that 6 out of 300 is 2 %.

Now say:

- If we didn't have grids to look at, what calculations could we do to get these answers?
  First look at 6 out of 200.

NAITB, Marr, Anderson & Tout, 1994

The trainees might say or do some of the following:

just halve the six or
six divided by two

The aim here is to show that some percentages can be found quickly by halving or dividing.

Try to get reasons for their responses?
If someone says divided by 2 ... ask why 2?
This will help the others.

Some people may say they cancelled, meaning:

$\frac{\cancel{6}^{3}}{\cancel{200}_{100}}$ in other words, dividing by 2

$$\frac{6}{200} = \frac{3}{100}$$

If people are using cancelling then point out that this is the same as dividing and is just as valid.

Use their responses to link $\frac{6}{200} = \frac{3}{100} = 3\%$

or 6 out of 200 is the same as 3 out of 100 which is 3%.
Don't bring up the cancelling routine if it isn't mentioned by your trainees first. Logic is more powerful in the long run.

Repeat also for 6 out of 300.

Presentation

Ask:

- What percentage would it be if there are eight sick people from a plant of:
  - (a) 200 ?
  - (b) 400 ?
  - (c) 800 ?
- How are you getting the answers?

Hopefully these sort of responses can be pulled together to arrive at a general rule .

For 200 divide by 2
For 400 divide by 4
For 800 divide by 8

Use their words if possible. to explain a rule of shortcut.

They may say something like:

How ever many 'lots of 100s you have, then just divide by that many'.

NAITB, Marr, Anderson & Tout, 1994

Go on making up your own examples until everyone seems confident. Using the hands-on material, allowing discussion amongst the trainees and getting them to give reasons for their responses, helps provide a range of explanations and methods.

This makes clear that there is not just one way to calculate these percentages quickly. This should benefit the trainees: even those who already know some of the shortcuts will have their understanding reinforced.

Part 3: Faulty parts

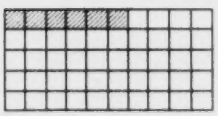
Distribute the 50 and 25 Grid Sets.

The grids will provide a model to help the trainees with the calculations and allow possible shortcut methods to be developed.

Ask:

- Six parts in each batch are faulty. What percentage are faulty if the batches have 50 parts?

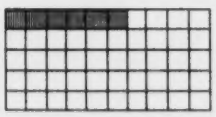
6



50

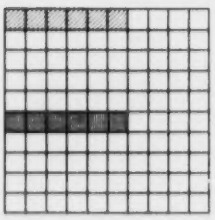
with

6



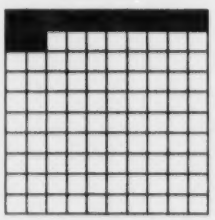
50

gives



which is

12

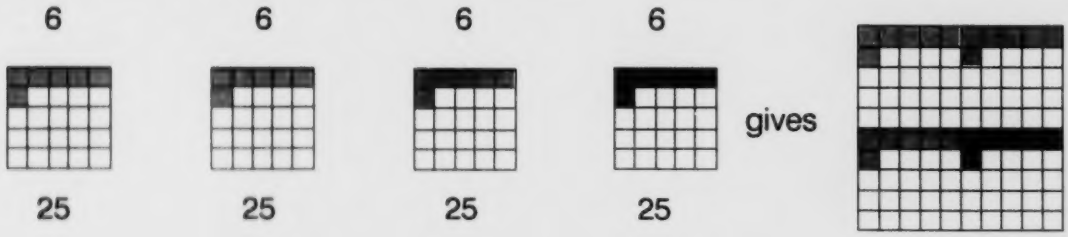


100

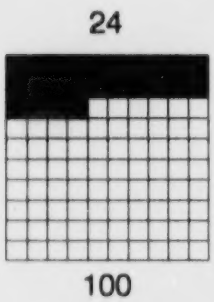
the same as 12 in one hundred or 12%

NAITB, Marr, Anderson & Tout, 1994

What percentage are faulty if the batches contain 25 parts?



which is



the same as 24 in one hundred or 24%

Ask:

- How did you use the grids?
- How can we do these questions without the grids?

Discuss by writing their responses on the board and use these to link:

6 out of 50 is the same as 12 out 100,
and
6 out of 25 is the same as 24 out of 100.

Trainees will give responses based on the methods they use in their heads.

Encourage them to do these questions mentally. This will lead to short cuts, which are desirable. If someone says multiply by 4 .... ask why 4? Try to get reasons for their responses, which will help others to understand.

Encourage trainees to do these in their heads.

NAITB, Marr, Anderson & Tout, 1994

Some may say multiply top and bottom by four, or demonstrate this method:

$$\frac{6}{25} \times \frac{4}{4} = \frac{24}{100}$$ (The opposite of cancelling)

$$\frac{6}{25} = \frac{24}{100} = 24\%$$

Do not emphasise formal writing down. Just relate it to other methods or rules if it comes up.

Put these questions to the group:

What percentage would it be if the six faulty parts were from a batch of:

a) 20 ? b) 10 ?

Use the short cut methods developed to show

6 out of 20 → 6 x 5 = 30 out of 100 = 30%, or

6 out of 10 → 6 x 10 = 60 out of 100 = 60%

Now hand out the Practice Sheet ***Defective parts*** to each trainee. Discuss the idea behind the tables before trainees attempt them.

Ask:
- ♦ Can you see what this table is about?
- ♦ What does the # symbol mean? etc.

This sheet can be done in class or at home. It is designed to give practice at using some shortcuts to calculate percentages.

Finally hand out the next Practice Sheet ***Percentage Attendance***. Again this can be done in class or at home using short, in the head methods. Ensure that trainees have a chance to discuss the table's meaning before attempting the calculations

NAITB, Marr, Anderson & Tout, 1994

Part 4: Using calculators

Activity

Now ask trainees to consider how they would do calculations like these on calculators when numbers are not as simple, like 6 out of 47.

Start with some familiar calculations first, e.g.

a) 6 out of 50 b) 6 out of 25 c) 6 out of 20

Possible questions:

- Can you do them on your calculator?
- Which buttons did you use?
- Do you get the same answer as before ?

Demonstrate using one of the questions as an example, how to do it using the % button.

$\frac{6}{25}$ → [6] [÷] [2] [5] [%]

Discuss whether the [=] key is needed or not.

It does not matter if some trainees divide and then multiply by 100 if this is a method they feel more comfortable with:

[6] [÷] [2] [5] [X] [1] [0] [0]

Now practise with more complex examples like 6 out of 47:

[6] [÷] [4] [7] [=] 12.76595

Use answers like this to discuss issues of rounding off.

Now hand out the Practice sheet ***Working percentages***.

NAITB, Marr, Anderson & Tout, 1994

Your notes and ideas

NAITB, Marr, Anderson & Tout, 1994

Defective parts

❶ Finish the table.

Week 5/4 - 9/4			Part Axles		
Day	5/4	6/4	7/4	8/4	9/4
# Defective	12	21	28	40	54
# Produced	200	300	400	500	600
% Defective	6%				

❷ Finish the table.

Week 12/4 - 16/4			Part Tailshafts		
Day	12/4	13/4	14/4	15/4	16/4
# Defective	14	16	15	21	22
# Produced	200	200	200	200	400
% Defective					

❸ Finish the table.

Week 19/4 - 23/4			Part Axles		
Day	19/4	20/4	21/4	22/4	23/4
# Defective	21	24		18	
# Produced	300	300	300	400	400
% Defective			6%		9%

Percentage attendance

❶ Finish the table.

Paint shop					
Week 3/5 - 7/5			Section Blue		
Day	M	T	W	T	F
Attendance	40	45	46	48	49
Total	50	50	50	50	50
% Attendance	80%				

❷ Finish the table.

Paint shop					
Week 10/5 - 14/5			Section Green		
Day	M	T	W	T	F
Attendance	18	21	22	19	17
Total	25	25	25	25	25
% Attendance	72%				

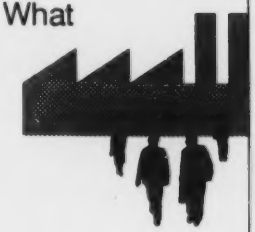
❸ Finish the table.

Paint shop					
Week 17/5 - 21/5			Section Red		
Day	M	T	W	T	F
Attendance	14	18	13	15	19
Total	20	20	20	20	20
% Attendance	70%				

Working percentages

How many of these can you do in your head?
Use a calculator for the others.

1. 8 people out of 200 are away from a factory because of illness. What percentage of people are away?



2. A bad production run caused 9 panels out of 20 to be faulty.
   What percentage is faulty?
   What percentage is OK?

3. On Tuesday 34 people were present out of a total of 40 people. Calculate the percentage of people who were there.

4. From a batch of 480 rotor shafts, only 12 were found to have defects. What is the percentage of defective rotor shafts?

5. This table for December 1992 shows vehicle registrations for each car company.

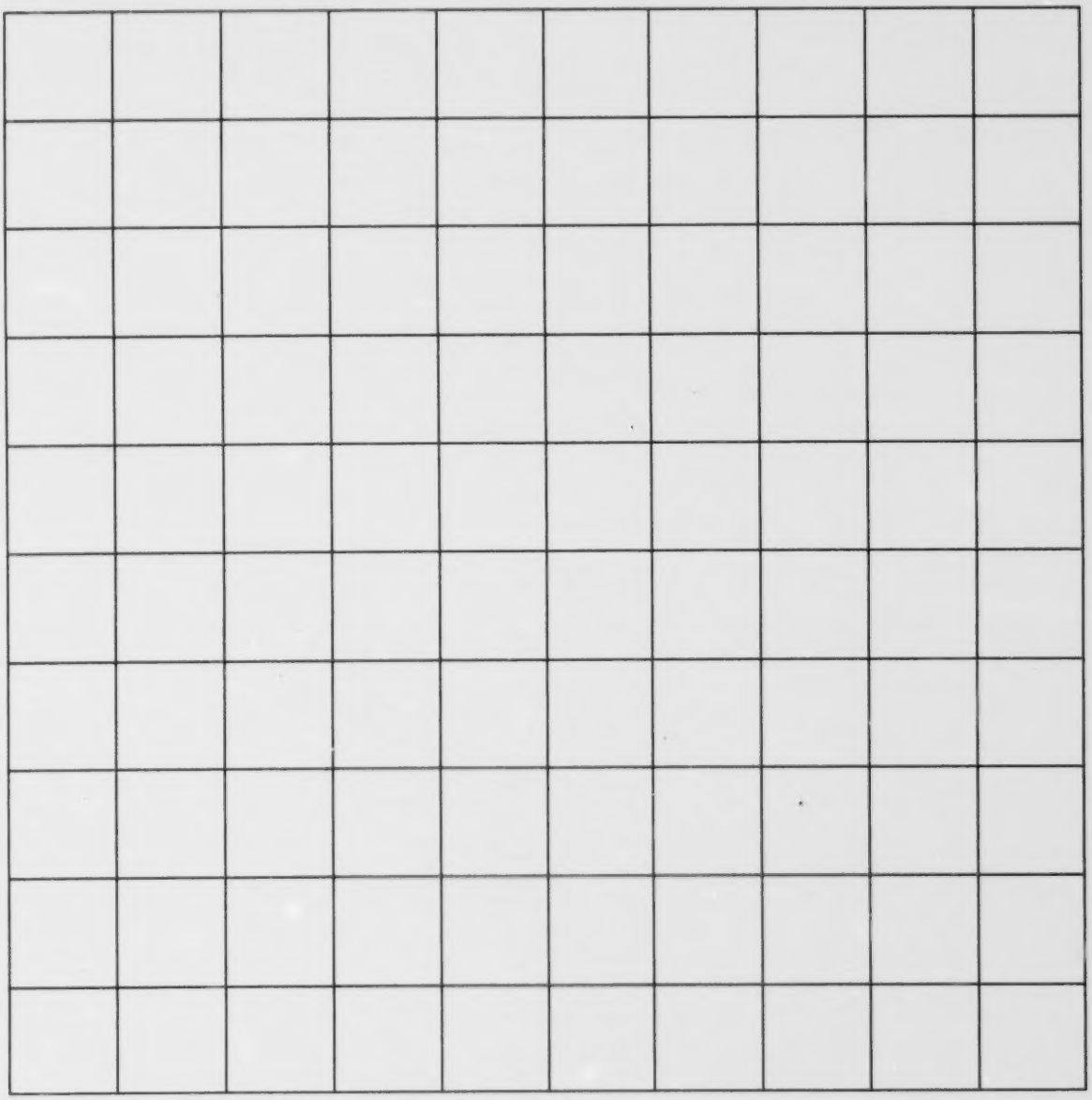
   What percentage of vehicles registered were:

   (a) Fords?
   (b) Holdens?
   (c) Mitsubishis?
   (d) Toyotas?

Manufacturer	No. of Vehicles
Ford	10,162
Holden	8,848
Mazda	2,057
Nissan	2,313
Mitsubishi	5,499
Toyota	5,981
Other	6,163
Total	**41,023**

(Source: A.B.S December 1992)

Hundred grid



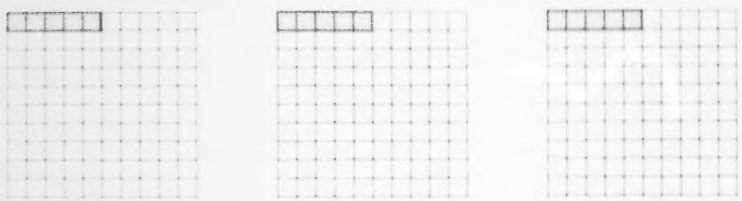
PERCENTAGES - MAJOR FACTS

- To find a percentage you always need to know the total.
- Percentage means: ***"out of 100", "in every 100", "per 100"***
- Percentage is written as **%**

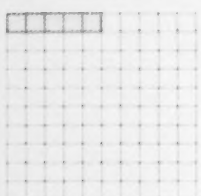
EXAMPLE

What percentage is 15 out of 300?

For 15 out of 300, then
how many out of 100?
15 out of 300 looks like:



So 15 out of 300 is the same as 5 out of 100.

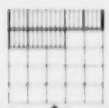


which is 5%

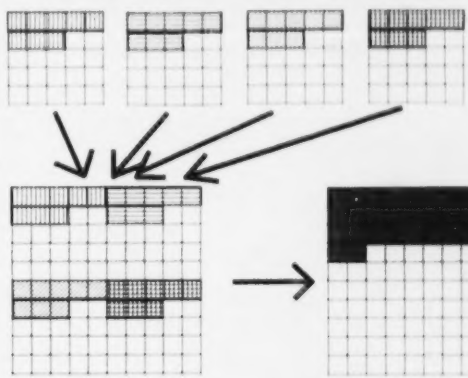
EXAMPLE

What percentage is 8 out of 25?

For 8 out of 25, then
how many out of 100?
8 out of 25 looks like:



Putting 4 of these together to make 100 gives:



8 out of 25 is the same as 32 out of 100.
So, 8 out of 25 is 32%

EXAMPLE: Percentages on your calculator

What percentage is 96 is out of 512? Press:

9 6 ÷ 5 1 2 % = **18.75** ***So, 96 out of 512 is 18.75%***

ANSWERS

Defective parts

- Finish the table

Week 3/4 - 9/4			Part Axles		
Day	5/4	6/4	7/4	8/4	9/4
# Defective	13	21	28	40	54
# Produced	200	300	400	500	600
% Defective	6%	7%	7%	8%	9%

- Finish the table

Week 12/4 - 16/4			Part Halfshafts		
Day	12/4	13/4	14/4	15/4	16/4
# Defective	14	16	15	21	22
# Produced	200	200	200	200	400
% Defective	7%	8%	7.5%	10.5%	5.5%

- Finish the table

Week 19/4 - 23/4			Part Axles		
Day	19/4	20/4	21/4	22/4	23/4
# Defective	21	24	18	18	36
# Produced	300	300	300	400	400
% Defective	7%	8%	6%	4.5%	9%

ANSWERS

Percentage attendance

- Finish the table

Paint shop					
Week 3/5 - 7/5			Section Blue		
Day	M	T	W	T	F
Attendance	46	45	46	48	49
Total	50	50	50	50	50
% Attendance	80%	90%	92%	96%	98%

- Finish the table

Paint shop					
Week 10/5 - 14/5			Section Green		
Day	M	T	W	T	F
Attendance	18	21	22	19	17
Total	25	25	25	25	25
% Attendance	72%	84%	88%	76%	68%

- Finish the table

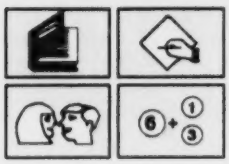
Paint shop					
Week 17/5 - 21/5			Section Red		
Day	M	T	W	T	F
Attendance	14	18	13	15	19
Total	20	20	20	20	20
% Attendance	70%	90%	65%	75%	95%

Working percentages

1. 8 out of 200 is 4%
2. 9 out of 20 is 45%
3. 34 out of 40 is 85%
4. 12 out of 480 is 2.5%
5. a) Fords - 24.77%
   b) Holdens - 21.57%
   c) Mitsubishis - 13.40%
   d) Toyotas - 14.58%

NUMERACY ON THE LINE

Charts and graphs - reading for meaning



NATIONAL AUTOMOTIVE
LANGUAGE & LITERACY
COORDINATION UNIT

Charts & Graphs - reading for meaning

Purpose

Graphs, or charts, are an effective means of conveying a great deal of information quickly. They are used widely in the modern workforce. However, to many of the workers unfamiliar with them, they remain a mysterious tool which they do not understand. Others, who do appreciate the messages told by graphs, lack the English language vocabulary to express their thoughts to other workers or supervisors.

The activities in this section are designed to help with the reading and plotting of charts and graphs and the use of English to discuss their messages. Part 1 contains activities to help trainees tune into the overall pictures or stories that graphs can convey. Part 2 uses the trainees' common sense and prior knowledge to analyse particular graphs in terms of the big picture, as well as reading specific points. To complete this section trainees sketch their own graphs, an activity which requires them to think about suitable scales.

Some of the different types of graphs that may be encountered in the workplace, such as run charts (line graphs), bar charts and Pareto diagrams, are covered in Parts 3, 4 and 5. Part 4 focusses on pie charts, whilst the final part requires calculations to be made, and gives trainees practice in plotting points and analysing charts.

NAITB, Marr, Anderson & Tout, 1994

Background

The initial activities in ***Charts and Graphs*** use quick group activities with cut out pieces to manipulate. These are used for a number or reasons:

- they allow for the introduction of technical language in a non threatening way;
- the activities can be done quickly without having to take the time worrying about copying and spelling new vocabulary or language introduced during the class;
- it is less threatening to move cut outs around than to cross out and re-write answers;
- the use of the cut outs also decreases the feeling of being 'wrong' and usually furthers both confidence and understanding;
- having only one set of pieces in the centre of the table also assists the small group to work together and talk about their decisions. This way, they will use more of the language than if they were using an individual worksheet.

While these activities take slightly longer to prepare than a standard worksheet the benefits from their usage make this extra preparation worthwhile. Anyway, once cut out, these activities can be reused many times.

What to prepare

- For each individual trainee you will need a copy of the following Practice and Activity Sheets:

- ❑ ***Pumping petrol 2***
- ❑ ***Pumping petrol 2 - statements***
- ❑ ***Types of charts***
- ❑ ***Pie charts***
- ❑ ***Reading pie charts***
- ❑ ***The ups and downs of attendance***
- ❑ ***Graphing production***
- ❑ ***Pareto plots problems***

- For each group of 2 or 3 trainees you will need separate labelled envelopes or plastic bags containing the cut up pieces from:

- ❑ ***Getting a line on graphs - statements***
- ❑ ***Comparable graphs - statements***
- ❑ ***Pumping petrol 1 - words***
- ❑ ***Blank grid***
- ❑ ***Which charts work?***

It is best to photocopy each of these activities onto different coloured cardboard.

NAITB, Marr, Anderson & Tout, 1994

♦ For each group of 2 or 3 trainees you will need a copy of the following Activity Sheets:

- ❑ ***Getting a line on graphs***
- ❑ ***Comparable graphs***
- ❑ ***Pumping petrol 1***

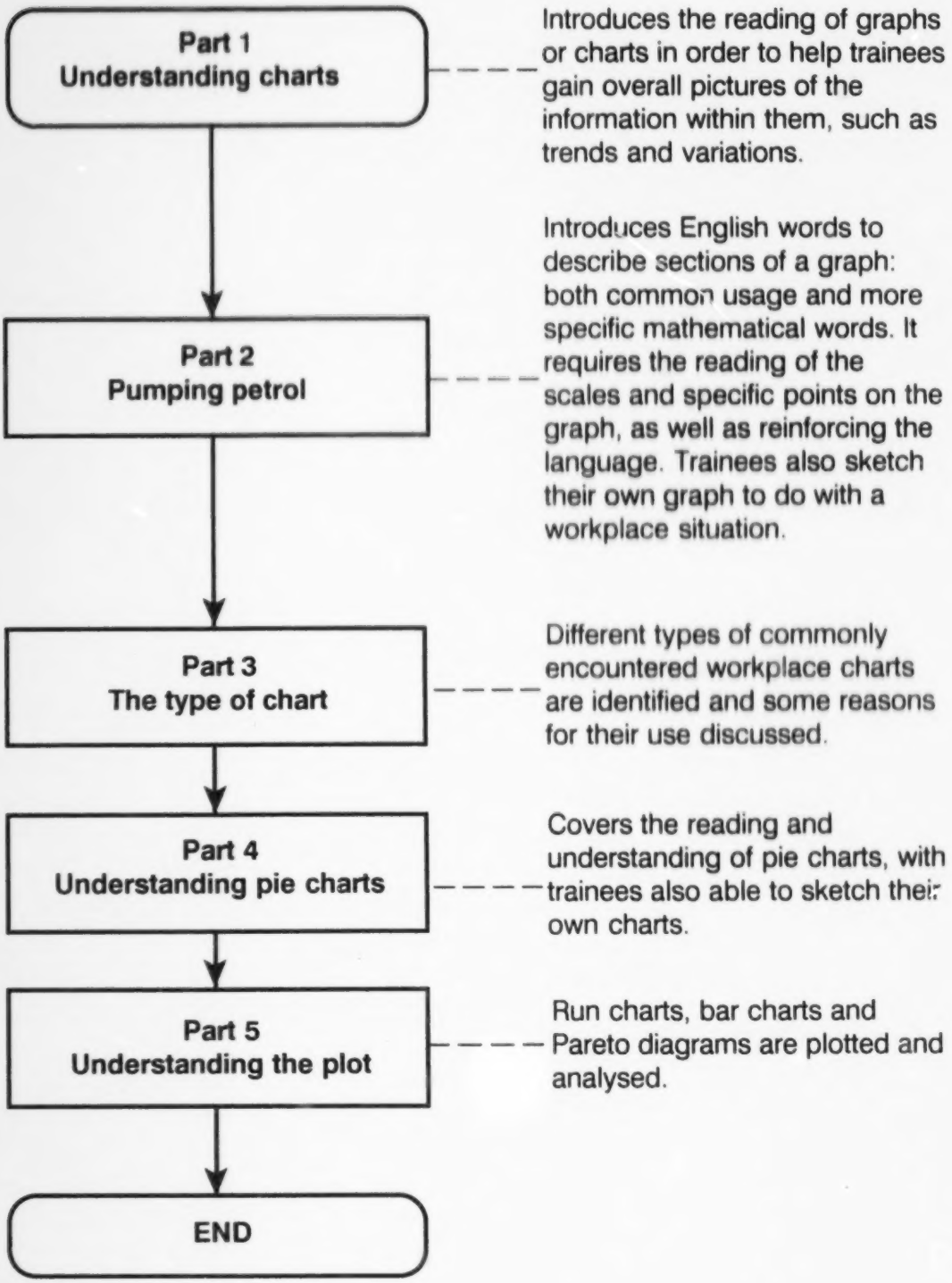
Optional

Make an overhead transparency of each of the following sheets:

- ❑ ***Pumping petrol 1***
- ❑ ***The ups and downs of attendance***
- ❑ ***Graphing production***
- ❑ ***Pareto plots problems***

NAITB, Marr, Anderson & Tout, 1994

Outline of section


Part 1
Understanding charts
Introduces the reading of graphs or charts in order to help trainees gain overall pictures of the information within them, such as trends and variations.
Part 2
Pumping petrol
Introduces English words to describe sections of a graph: both common usage and more specific mathematical words. It requires the reading of the scales and specific points on the graph, as well as reinforcing the language. Trainees also sketch their own graph to do with a workplace situation.
Part 3
The type of chart
Different types of commonly encountered workplace charts are identified and some reasons for their use discussed.
Part 4
Understanding pie charts
Covers the reading and understanding of pie charts, with trainees also able to sketch their own charts.
Part 5
Understanding the plot
Run charts, bar charts and Pareto diagrams are plotted and analysed.
END

NAITB, Marr, Anderson & Tout, 1994

Part 1: Understanding charts

Activity - Getting a line on graphs

Hand out to each group a ***Getting a line on graphs*** sheet and an envelope containing the ***Getting a line on graphs statements***.

Ask groups to match each statement with a graph or chart. Hold up one statement and the graph sheet to make this clear.

Allow time for groups to complete the activity. Move amongst the groups to help generate discussion.

Check understanding when they have finished by discussing solutions and asking trainees to say why they matched each statement to a particular chart.

Use the questions below to introduce and develop understanding of the words: range, fluctuating, increasing, decreasing, and trend.

Ask:

- Which of these charts would make the employer happy? Why?

  Answer: Probably charts 1 and 3 - attendance rising or already high.

For each graph ask:

- Was the range of attendance small or large?

  Answer: Chart 3 small - others probably high.

- Was attendance increasing, decreasing or fluctuating?

  Answer: Fluctuating for charts 2 and 4.

- Do any of these charts show a trend? Which one/s?

  Answer: Chart 1 - the trend is increasing.

Activity - Comparable graphs

To each group distribute a ***Comparable graphs*** sheet and an envelope containing the ***Comparable graph statements***.

NAITB, Marr, Anderson & Tout, 1994

Ask groups to match each statement card with a chart.

Move around the room to prompt discussion within the groups as they complete the activity.

As before discuss their solutions and the reasons behind them.

Ask:

- Look at Chart 1. How else could it be described?
  Answer: Day not as good as night.
- Which of these charts would make the employer happy?
  Answer: Chart 2 as both shifts improving. Possible other responses: chart 3, happy with day shift; and chart 1, happy with night shift.
- Which of the charts has the widest range?
  Answer: Chart 3, night shift.
- Is there any way that the chart could be redesigned to make the trends and range clearer?
  Answer: Using a bigger scale on a vertical axis would help - only need to show 60% or 70% up to 100%.

Part 2: Pumping petrol

Activity - Pumping petrol 1

To each small group distribute a ***Pumping petrol 1*** graph.

Ask the groups to look at the graph.

Explain to the whole class that the vertical axis is measuring the amount of petrol in the underground tank at a small service station.

As a group they should see if they can decide what 'story' the graph might be telling them.

If they need more prompting use specific questions, for example:

- What do the level bits tell you?
- What about these steep bits? etc

NAITB, Marr, Anderson & Tout, 1994

Discuss some of the ideas they come up with - see if there is agreement on each.

Now say:
We are going to look at the words and phrases you would use in English to describe this graph.

Give out the envelope containing the ***Pumping petrol 1*** words, and tell trainees that they have to place the cards from the envelope onto the graph in the most likely positions.

Use an overhead transparency of the graph and compare where groups have placed the words. It will help to write the words onto the overhead transparency or project the transparency onto a whiteboard and write the words on the board.

Point to various parts of the graph and get trainees to describe each section using their own words. Use this to build up a vocabulary list on the board.

Activity - Pumping petrol 2

To each group distribute a ***Pumping petrol 2*** graph. Explain that this looks the same as the last but this time it has numbers on the axes.

Choose from these questions depending on the capabilities of the people in the groups.

To tie in with their stories from Graph 1 and to give practice at reading from the graph, ask questions like those following, until everyone in the group has an idea of how to read the graph and understands the scales.

Give them time, as a group, to decide answers to the questions, allowing time for individuals to assist each other in reading the scales and interpreting the graph.

Possible questions:

- How much petrol was in storage when the station opened? When it closed?
  Answer: Opened - 100 kilolitres, closed - 124 kilolitres.
- When was there 130 kilolitres in storage?
  Answer: 8.00 pm, and for an instant during filling.

NAITB, Marr, Anderson & Tout, 1994

- How much petrol was in storage at 6 pm, 12.30 pm and 9.15 am?

  Answers:

6.00 pm:	*140 kilolitres*
12.30 pm:	*150 kilolitres*
9.15 am:	*95 kilolitres*

- When were the busiest times?

  Answer: 8.00 am to 10.00 am & 5.00 pm to 8.00 pm

  - How do you know?
  - Why would this be?

  Answer: -Steepest slope - most petrol being sold.
  -Peak hours for people driving to and from work.

- What happened at 11.30 am?

  Answer: A tanker arrived and filled the tanks.

- How much petrol did the tanker deliver?

  Answer: About 58 kilolitres.

- How big do you think the underground tank is?

  Answer: 150 kilolitres, providing it was filled right up.

- How often do you think the tanker would need to come?

  Answer: About every two days.

- Can you tell which side of the road the petrol station is on: the left hand side going into the city or the left hand side coming from the city? Why?

  Answer: Probably the left hand side coming from the city because sales are higher in the afternoon. Other interpretations are possible.

Hand out the ***Pumping petrol 2 statements*** sheet, one per person or pair.

The groups need to use both the graph and the words in the box at the bottom of the sheet to help complete the statements. In the box there are two possible words for each statement, so two spaces to fill in.

Allow time for groups to finish. Check understanding by comparing which words were used in each statement.

Extension or Replacement Activity

Use workplace charts or graphs to mirror this activity - place the cards on actual workplace graphs, or even slightly exaggerated versions. Make up sentences similar to the accompanying Activity Sheet, which describe your own workplace graph.

Discuss the real workplace implications of sharp rises, constant results, and gradual decreases.

Activity - Creating your own charts

The aim of this activity is to get trainees to create charts or graphs of their own which tell a story (similar to the petrol graph). This will involve creating their own scales and therefore gaining a greater understanding of scales and axes than they would by merely plotting points or reading from a graph.

Think of a situation, or quantity, relevant to your workplaces that changes over a 12 or 24 hour period - one which would be familiar and manageable to your group of trainees.

Examples could be:

- The number of people in the work canteen at any time over a 12 hour period.

  Answer: This would probably show peaks at morning tea and lunch times.

- The number of people working in their plant at any time over a 24 hour period.

  Answer: Should show steep rises and falls at shift change times.

- The number of particular component parts in a bin over a 12 or 24 hour period.

  Answer: Should show steep rises regularly when refilling occurs, and constant levels when no-one is working.

After deciding on one situation for the group to graph, hand out one copy of the ***Blank chart*** sheet to each pair of trainees and ask them to create their own imagined version of the graph.

Tell them to make sure that scale markings are shown clearly and axes are labelled.

Allow plenty of time for discussion.

Move around the room to give help and ask questions about their graphs.

NAITB, Marr, Anderson & Tout, 1994

The more experienced the trainee, the more probing your questions can be. Concentrate on making sure everyone becomes a little more skilled at creating charts or graphs than they were before.

Remember this is a learning experience focussing on axes and scales as well as the trends looked at previously. Everyone will probably gain something different from the exercise.

At the end ensure that each pair's chart is looked at and their story interpreted - either by you, the Trainer, or other class members. Pairs could swap graphs between them.

Extension

- Ask trainees to write the story, or some short sentences, about their own, or other peoples', graphs.
- Use the word cards from ***Pumping petrol 1*** to label parts of their own graph or ask them to write similar labels on their own graph in coloured pen.

Part 3: The type of chart

Activity - Which charts work?

Ask trainees to work in pairs for this activity.

Hand out on envelope containing the activity ***Which charts work?*** to each pair.

Say:

- Each statement or fact card matches **two** of the chart cards.
- Match the statements with the charts. You should have 3 groups of 3 cards.

Allow time for trainees to complete this activity.
Move around the room to promote discussion.

Compare results from each group. Ask questions about how they decided which chart belongs with a particular statement.

Ask:

- Do you know what some of these kinds of charts are called? If so which ones?

If trainees do not offer suggestions you could begin by asking questions containing more pointed hints:

- Are any of them called Bar Charts? Run Charts? (line graphs)
- Do you know which is a Pareto Diagram?
- Do you know which is a Pie Chart?

The names will be reinforced in the next few activities so it is not necessary for trainees to learn them all at this stage. However, as a record of this activity, and to assist in the following discussion, you could hand out the ***Types of charts*** Summary Sheet.

Now discuss the differences between the types of charts and what they are used for. Ask trainees to keep their groupings of three cards in front of them for this discussion.

Possible questions:

- What are the differences between the two run charts 1 and 6?

  Answer: 1. is recording two things at once, while 6. records only one.

- What are the differences between the Bar Charts 2 and 5?

  Answer: 5. is also recording two different measures.

- Which ones have **time** along the bottom (horizontal) axis? Or which ones change over time?

  Answer: 1, 2, 5, 6.

- Could a Pie Chart like 4 be used to show something that changes over time?
  - Why or why not?

Pie charts and Pareto diagrams are used to show comparisons of different quantities at a given time eg percentage market share or sales figures for different companies this year; whereas run charts and bar charts are used to show trends changing over time, eg a particular company's sales figures changing over a year.

Extension question:

- What are Pareto Diagrams like 3 used for in your workplace?

Part 4: Understanding pie charts

Activity - Pie charts

To each pair of trainees hand a copy of the Activity Sheet ***Pie Charts***.

Ask:

- Which type of vehicle do they make most of?
- How do you know?
- What percentage is this type out of all the cars made?

After this introduction to Pie Charts trainees should complete the rest of Question 1.

Check their understanding by discussion.

Ask:

- If we add all the percentages on the pie chart what do we get?
- Is this true for all pie charts?

Extension Activity - Making a pie chart

- What type of car do you drive, 4 cyl, 6 cyl etc. Does anyone have a four wheel drive?
- Roughly what percentage is this of all our groups vehicles?

As a group, make a pie chart to represent type of car ownership in the class or, to get even better results, go out of the room and each ask 10 other people for their type of car. Use a photocopy of the ***Blank pie chart grids*** sheet.

Now go to question 2 on ***Pie Charts***.

Source of question 2 - Work Placed Education Project Survey 1992 - a representative sample of workers in the Victorian Automotive Industry.

Ask:

- What is the percentage of Asian workers?
- How do you know? (Refer to the whole pie being 100%).

Allow time for trainees to complete the questions. Check understanding again by going through their responses.

NAITB, Marr, Anderson & Tout, 1994

Possible questions for discussion:

- What would your workplace chart look like?
- What nationalities may be in the European group? Asian group?
- What nationalities may be in the 'other' group?

Extension

Give out a blank pie chart to trainees in pairs or groups - one per group. Ask them to quickly draw what they think will be an approximation of a similar pie chart for their plant or factory.

Make sure that the 'slices' are labelled with their percentage and that everyone is aware to check that the percentages add up to 100.

When this is done the group can compare their charts and see how similar their guesses are.

The next Practice Sheet, ***Reading pie charts***, should be used to follow up this sheet. It can be done in class in pairs or at home for practice.

Part 5: Understanding the plot

Activity - The ups and downs of attendance

There are several purposes for this activity: it gives further practice at reading and interpreting graphs; it involves the plotting of points and therefore requires the interpretation of a scale; and it involves the calculation of percentages using methods similar to those used in the workplace (although simplified a little).

To each pair of trainees hand a copy of the Activity Sheet, ***The ups and downs of attendance***.

Ask them to answer the first two questions by reading the chart (graph). If necessary use an overhead transparency of the activity sheet to help explain what is required.

It is beneficial for the trainees to do the first two questions in pairs rather than individually because it makes the task less threatening and, more importantly, promotes useful discussion.

Before they do Question 3, hand out extra sheets so that everyone has a chance to plot their own points on the chart.

Allow time for them to complete the two questions. Check their understanding by comparing responses. When doing this highlight reading from the graph not the table. Some trainees may obtain the percentages by calculating the figures in the table without reading the graph or chart. If so, link the figures in the table to those on the chart and make sure they can understand the scale in order to read from the graph.

Now hand out extra copies of the Activity Sheet so that everyone has their own sheet in order to complete the table and the chart.

Make sure that you discuss how to fill in the spaces in the table. Since the chart/graph shows **percentage** attendance it is essential to know the number **per hundred**.

Filling in the table may either open up a discussion on the meaning of percentage or reinforce the idea.

eg. *44 in 50 is*
88 in 100 → 88%

or *86% → 86 in 100 becomes*
43 in 50

Move around and help where necessary. Again use the overhead transparency to check understanding.

Now get trainees to finish the rest of the sheet and to talk about their answers with each other. Again check their understanding using the overhead.

Question 4 can be used to reinforce language development from the earlier activities in this section.

Discuss some of the messages given by the graph and practice some of the vocabulary introduced earlier with the following questions.

Ask:

- Why would the attendance fall so much in June, July and August?
  Answer: Winter - sickness of employees or their children
- Which months had the sharpest falls?
  Answer: June and November
- Which months had the steepest rise?
  Answer: September and December

NAITB, Marr, Anderson & Tout, 1994

Activity - Plotting run and bar charts

To each trainee distribute a copy of the Activity Sheet, ***Graphing production***. Explain that this is a chart used in many companies to record daily production figures in each section. This section makes Cylinder Heads for car engines.

Using an overhead transparency of the sheet ask trainees to show you where the production for the first few days should be plotted. Then join the up the points with a straight line to start the line graph or run chart. Ask trainees to complete the rest of it themselves.

Allow time for them to finish and use the overhead transparency to check their solutions.

Ask:

- What might cause the production to vary from day to day?

  Possible answers: Machine maintenance or breakdown, workers absent, other products being made ...

Now refer trainees to the second chart. Say, that sometimes bar charts are used instead of run charts and they will now have a look at one.

Ask:

- Can anyone see what this chart is about?
- What do you think 'Percentage OK' means?
- Where would the top of the bar for Day 1 be?
- How wide should it be?
- Do you know other ways of saying or describing Percentage OK?
- What term does this factory use?
- Why would the Percentage OK (or use their terminology) vary?

  Possible answers: Faulty machines or settings, worker inattention, faulty parts going into machines, etc.

'Percentage OK' is the percentage of parts produced for the day which are acceptable or usable immediately.

Let the trainees try days 2 and 3 and check their understanding using the overhead transparency. Then get them to complete the bar chart.

NAITB, Marr, Anderson & Tout, 1994

Now ask the groups to refer to both graphs.

Ask:

- Can you see any connections between the shape of the graphs?
- When the production is high for a particular day what happens to the Percentage OK?

  Answer: Percentage OK figure drops.
- What could cause this?

  Possible answer: Rushing production could lead to more mistakes being made.

Finish off the discussion of this activity by comparing the advantages of each type of chart as follows.

Possible questions:

- Which of these two charts was easier to plot? Why?
- Would it have made any difference if the Production was plotted with a bar chart and the Percentage OK with a run chart?

  Possible answers to these questions: Probably no difference, graphs are interchangeable.
- Is it necessary to connect the points in a run chart?
- Why do people usually connect the points.

Connecting points on a run chart makes it easier to see trends or distinguish easily where the points are.

Activity - Pareto plots problems

Ask:

- Have you seen Pareto charts?
- What are they used for?

If necessary, have the overhead transparency, ***Types of charts***, to remind trainees what a Pareto diagram looks like.

Hand out the Activity Sheet ***Pareto plots problems***.

Say:

- These were faults found on door panels for a day. We will use these figures to draw a Pareto diagram.

Ask trainees to do Question 1.

NAITB, Marr, Anderson & Tout, 1994

Allow trainees time to think about the scale themselves, but if it is apparent that most need help, draw their attention to the overhead transparency of the Activity Sheet ***Pareto plots problems*** and discuss as follows.

If trainees have trouble deciding on a scale discuss it with the whole group together.

Ask (if necessary):

- What scale do you think we should use here?
- Should we go up by ones, two, fours, fives?

When the scale is decided upon allow time for the trainees to complete the diagram. Check their understanding by using the overhead transparency. Make sure that trainees write the type of fault in the space under each bar.

Use an overhead transparency and ask the group where to draw each bar.

Ask:

- Why was scratches first?

  Answer: It was the largest figure

The fault that occurs most is put first the next most common fault second, and so on. This is so that the most common faults are more prominent, and can be addressed first if possible.

Now refer trainees to question 2.

Ask:

- How many dents were there?

  Answer: 14
- How do you know?

  Answer: by counting the tally marks 5 + 5 + 4.
- How many paint faults were there?

  Answer: 11 (5 + 5 + 1)
- How many other faults were there?

  Answer: 6
- Which bar will we draw first?

  Answer: Dents
- Which bar will be next?

  Answer: Scratches

Now ask the group to draw the Pareto diagram, choosing a scale which fills most of the graph.

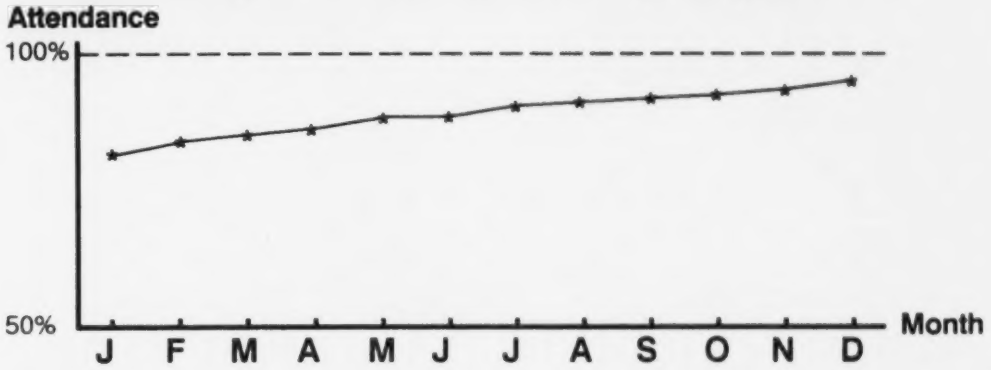
NAITB, Marr, Anderson & Tout, 1994

Your notes and ideas

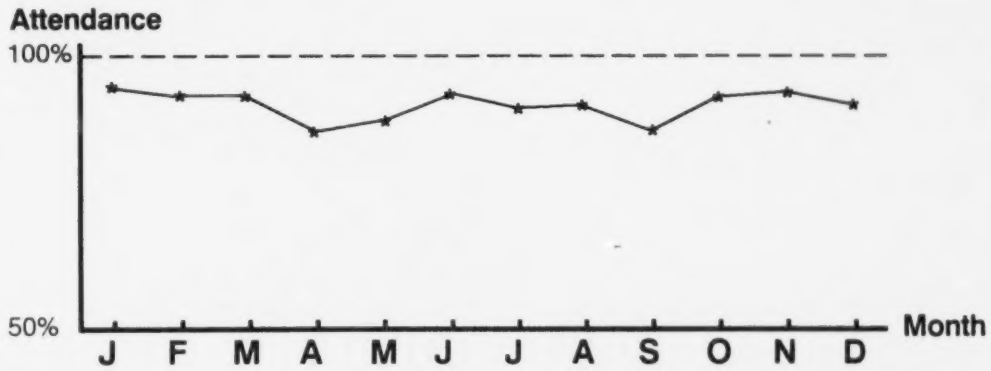
NAITB, Marr, Anderson & Tout, 1994

Getting a line on graphs

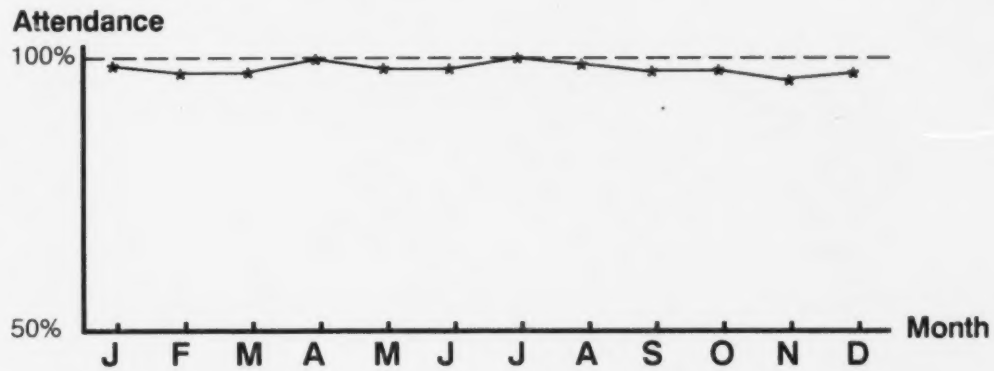
❶



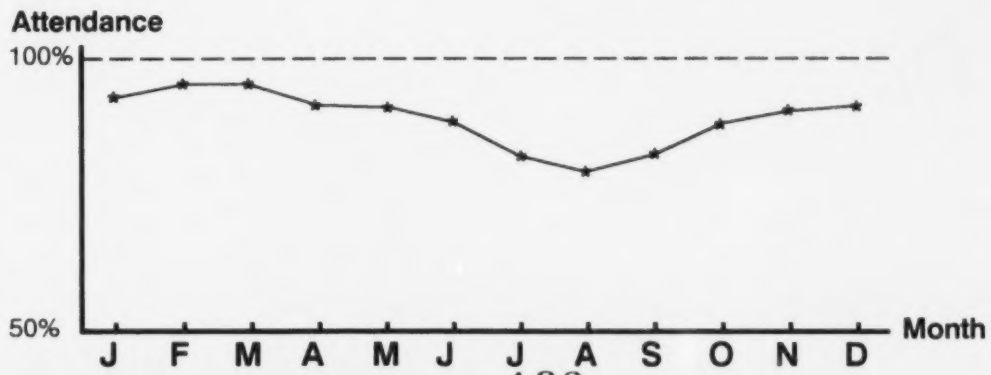
❷



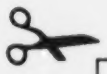
❸



❹



Getting a line on graphs - statements

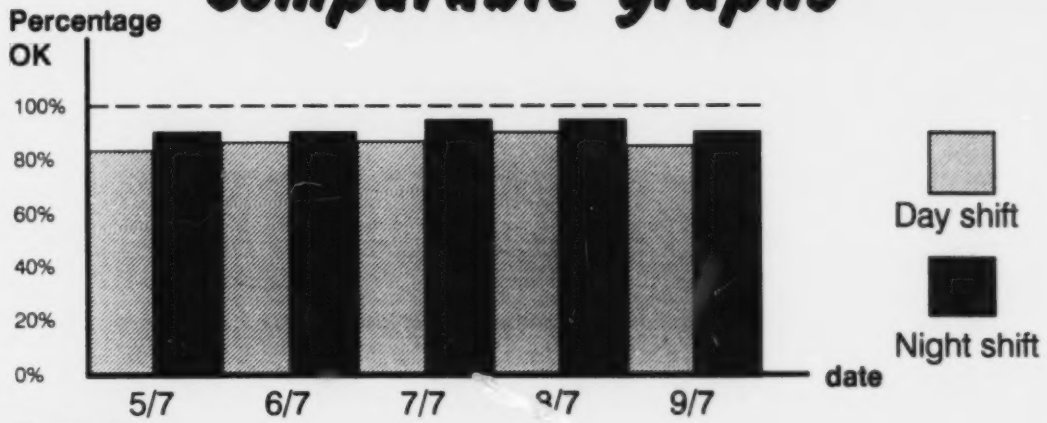


attendance getting better
attendance falls in winter
attendance always high
attendance is unpredictable

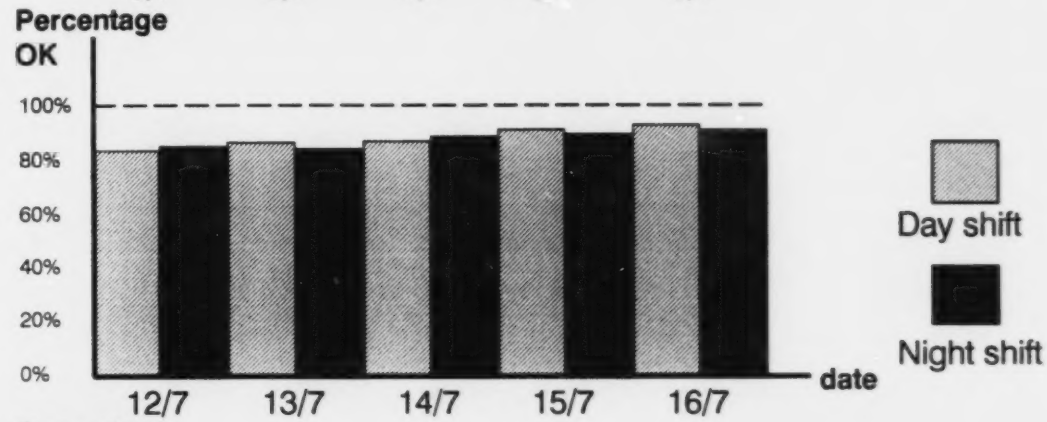
attendance getting better
attendance falls in winter
attendance always high
attendance is unpredictable

Comparable graphs

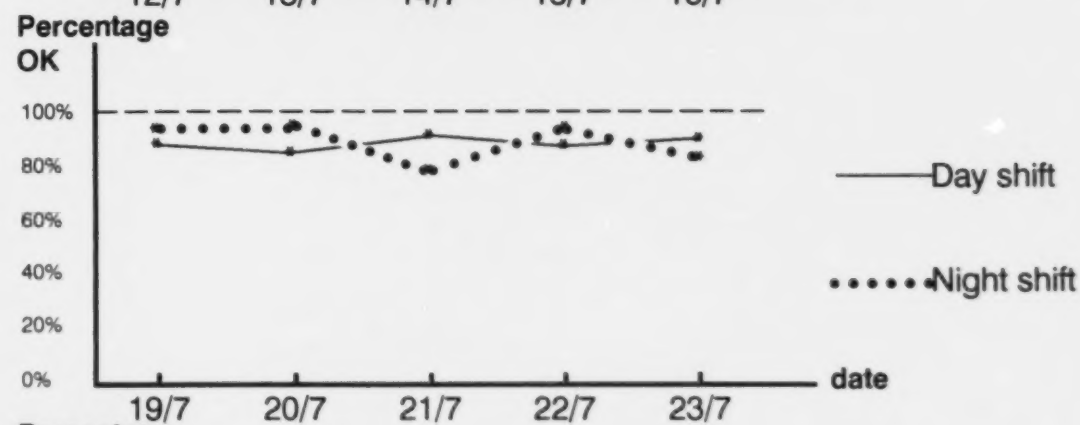
1.



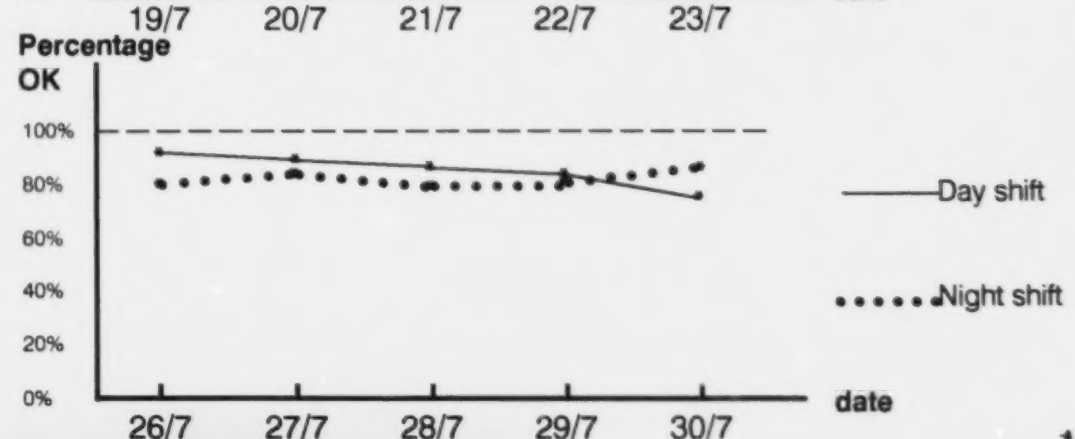
2.



3.



4.

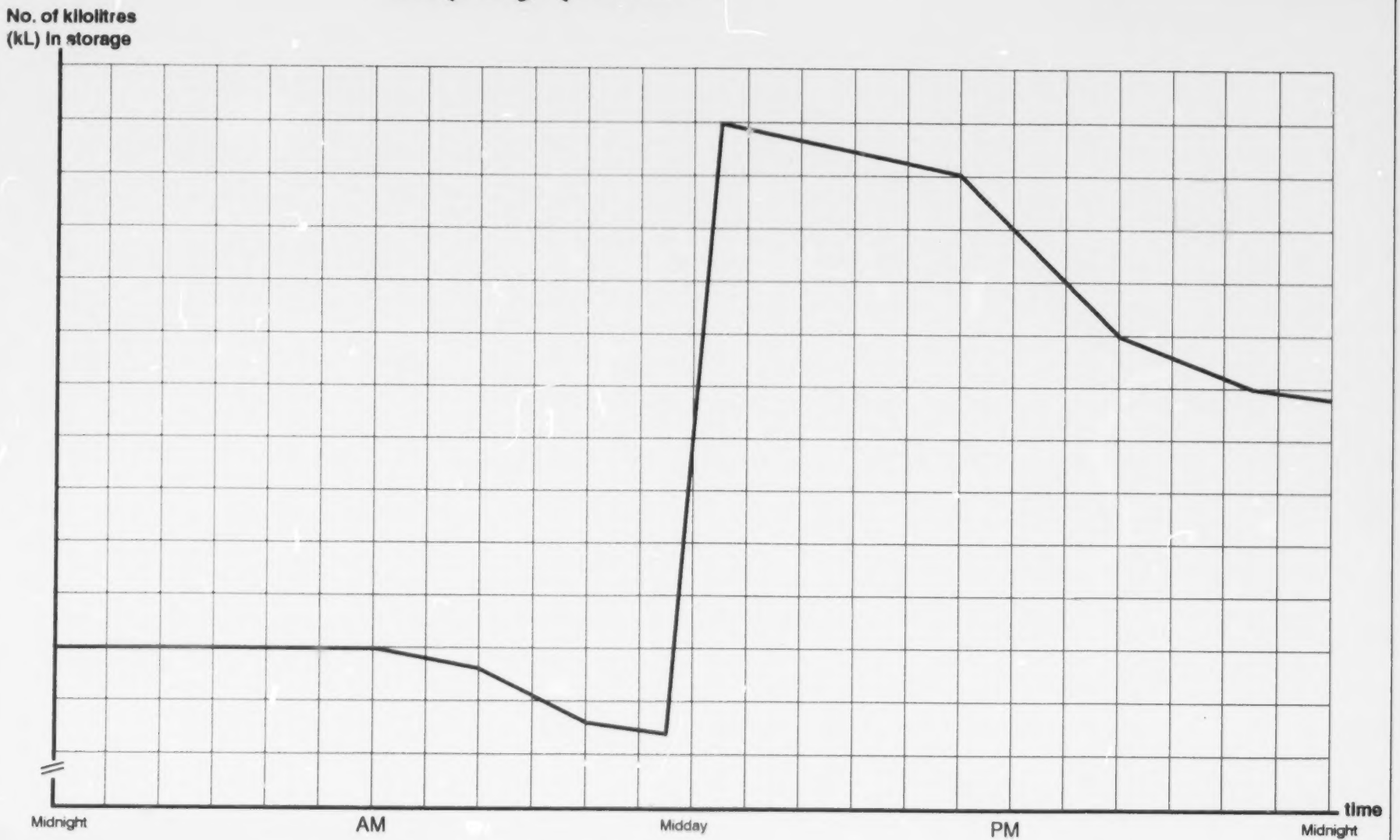


Comparable graphs - statements

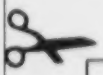
night better
both improved
night has more variation
day decreasing

night better
both improved
night has more variation
day decreasing

Pumping petrol 1



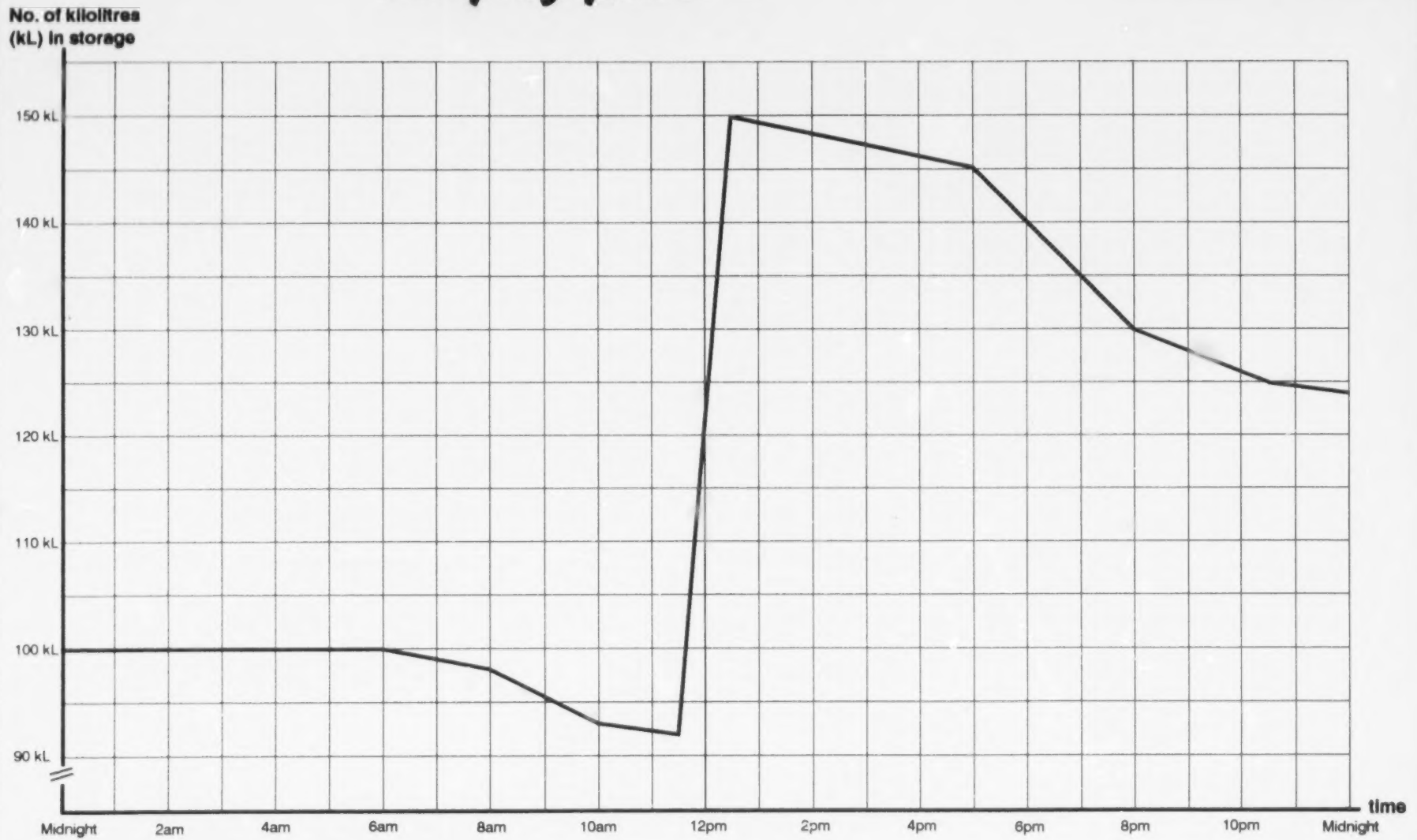
Pumping petrol 1 - words



maximum
minimum
constant
sharp rise
gradual decrease

maximum
minimum
constant
sharp rise
gradual decrease

Pumping petrol 2



Pumping petrol 2 - statements

Use **two** words from the list below to complete each of the statements about the graph, ***Pumping petrol 2***.

❶ After 5 pm the slope was _____ than before 5 pm.

❷ Between midnight and 6 am the number of kilolitres of petrol in storage was _____ .

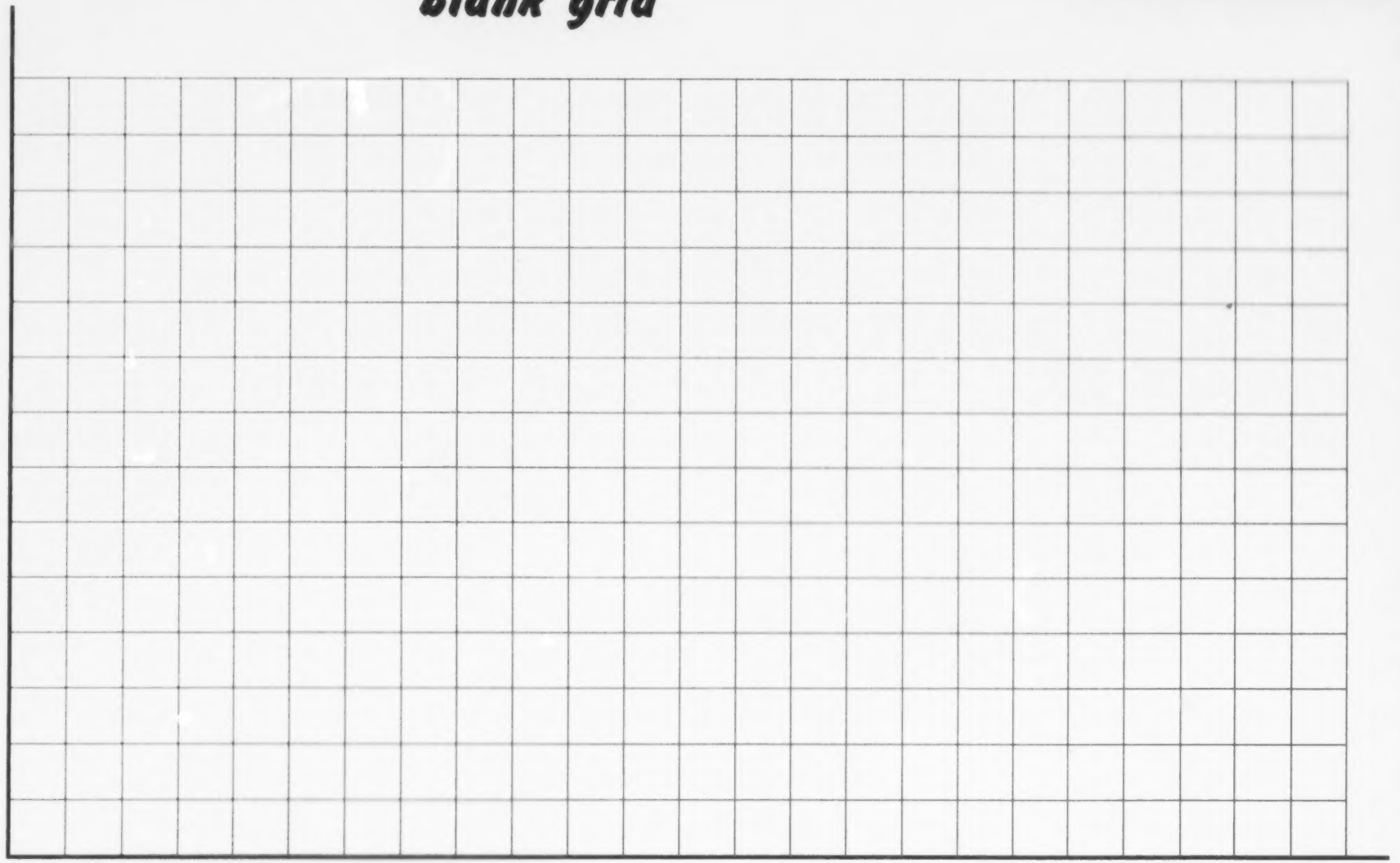
❸ The amount of petrol was _____ at 12.30 pm.

❹ The gradient from 6 to 8 am was _____ than from 8 to 10 am.

❺ The rise was _____ between 11.30 am and 12.30 pm.

sharpest	*constant*	*steepest*	*maximum*	*less*
highest	*steeper*	*not changing*	*smaller*	*greater*

Blank grid

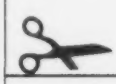


172

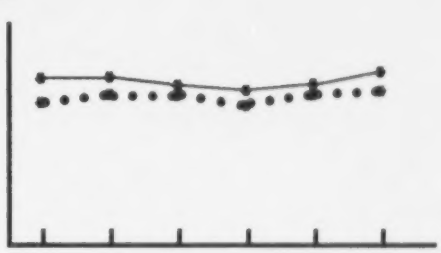
173

NAITB, Marr, Anderson, & Tout, 1994

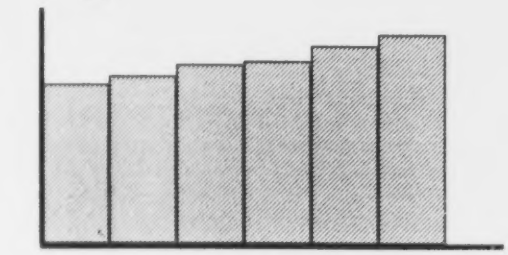
Which charts work?



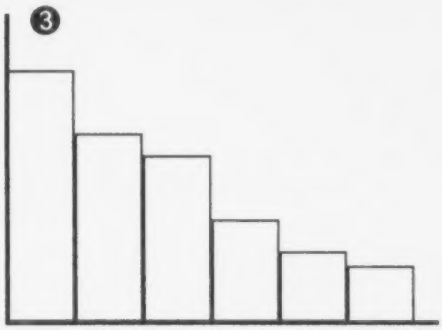
❶



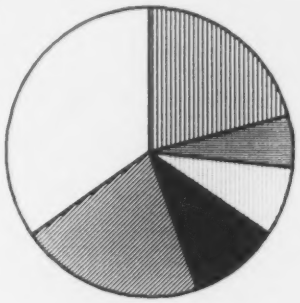
❷



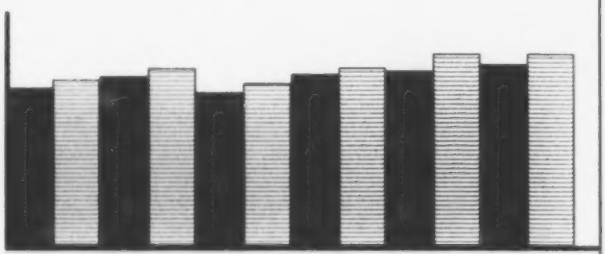
❸



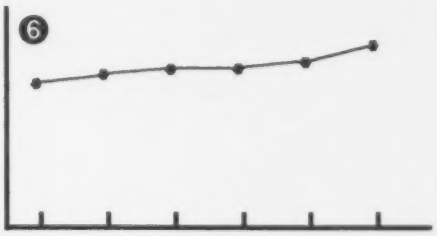
❹



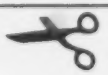
❺



❻



There are 6 main types of workplace accidents	Over 6 months the quality of work has improved.	This year production for the first 6 months is better than last year.

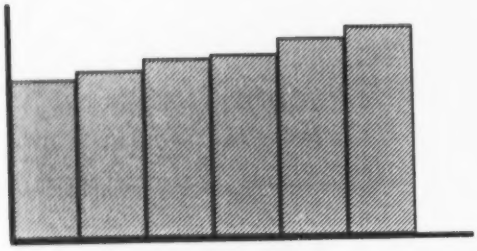


Types of charts

❶

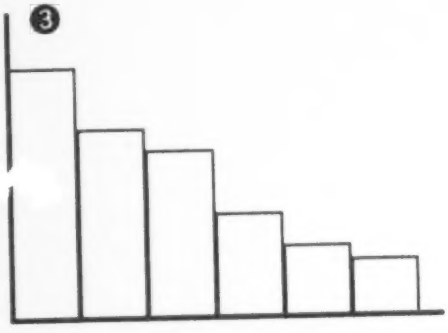
Run chart or line graph

❷



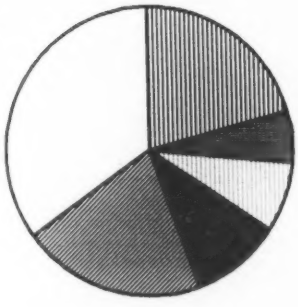
Bar chart

❸



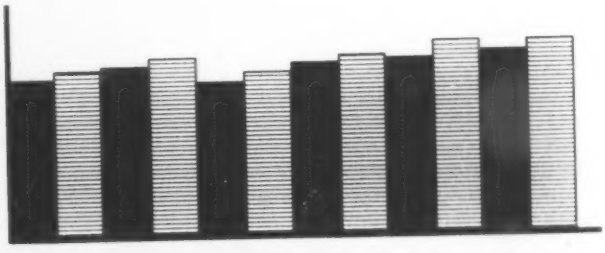
Pareto diagram

❹



Pie chart

❺



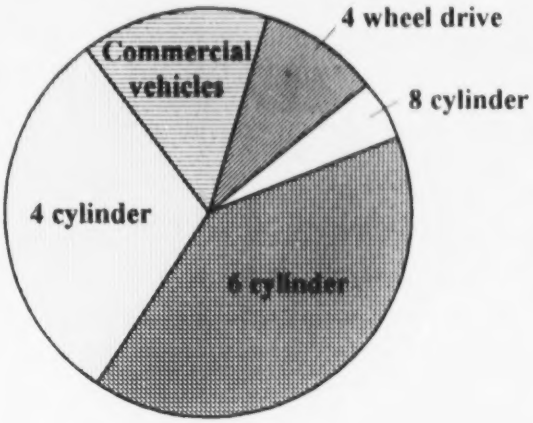
Bar chart

❻

Run chart or line graph

Pie charts

❶ Button Car Factory makes the following types of vehicles.



Fill in the percentages using the figures from the box below.

4 cylinder: _____ %

6 cylinder: _____ %

8 cylinder: _____ %

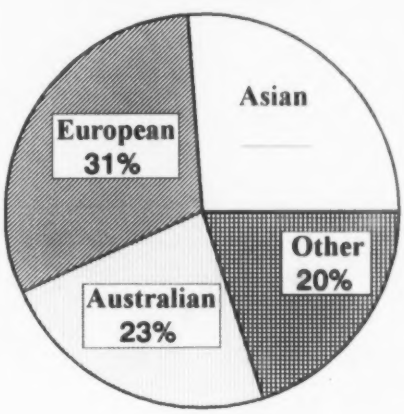
4 wheel drive: _____ %

Commercial vehicles: _____ %

The total is: _____ %

5%	10%	15%	30%	40%

❷ Where workers come from.
These are figures from a survey.

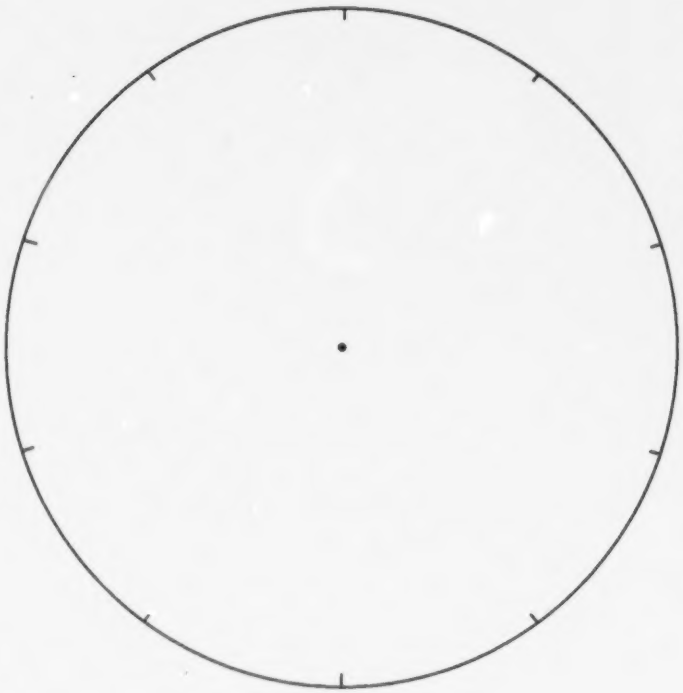


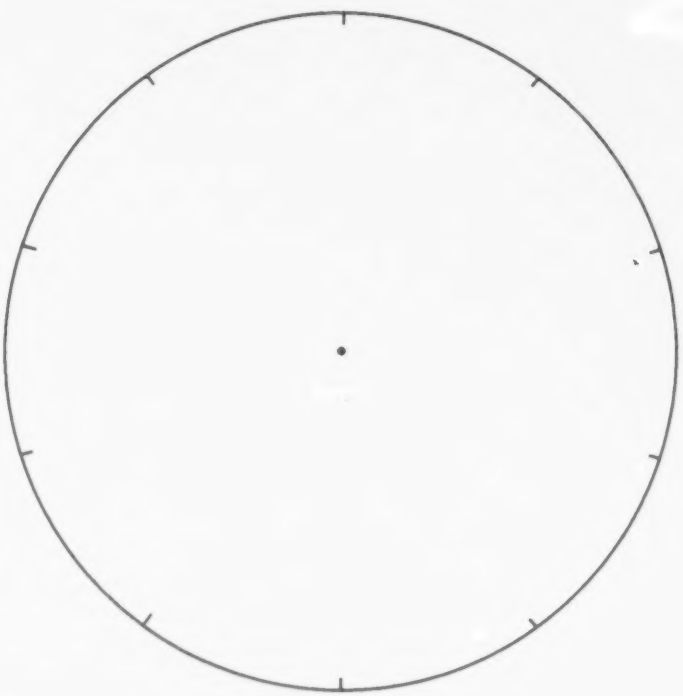
The largest group was _____.

The smallest group was _____.

The Asian group was _____%.

Blank Pie Chart grids

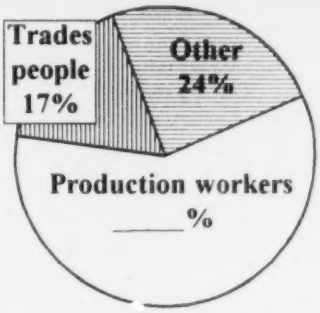




Reading pie charts

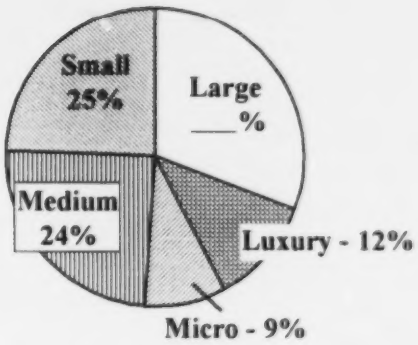
Find the missing percentage.

❶



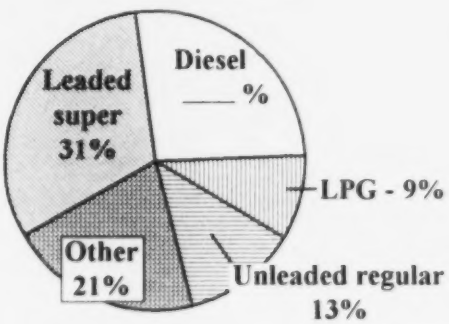
Victorian Manufacturing Sector
VAITB Industry Training Plan '91-'94

❷



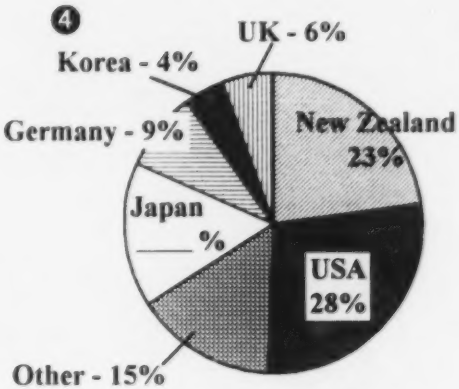
Car sales 1992
PAXUS Corporation Limited

❸



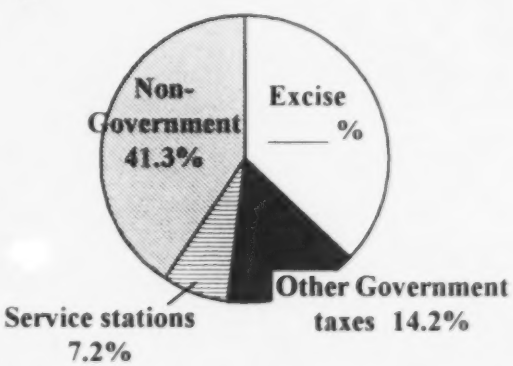
Petroleum Products 1990
Aust. Institute of Petroleum

❹



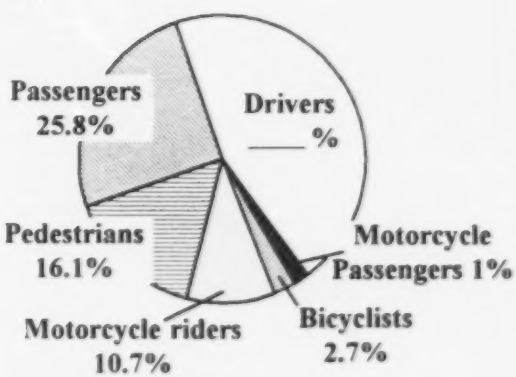
Automotive Exports 1992
Aust. Bureau of Statistics

❺



Petrol Money 1992 - where the money went
Black & White Data Book

❻

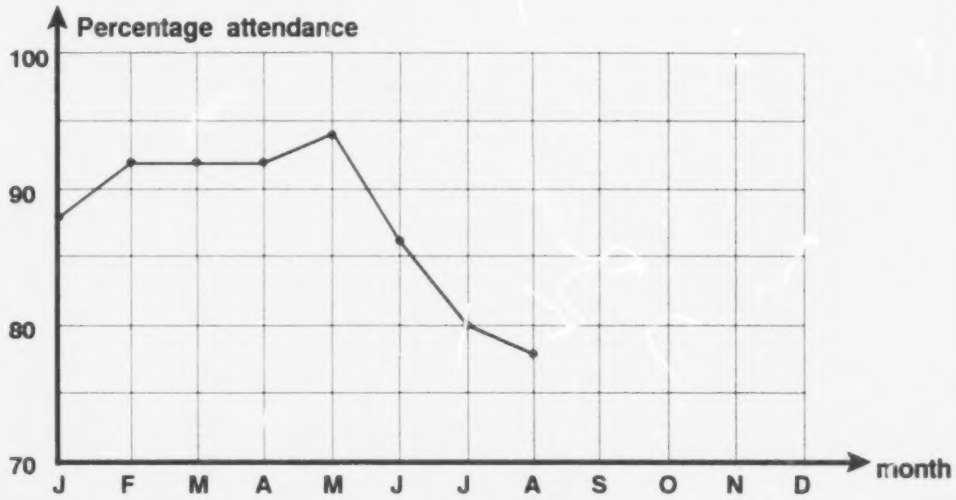


Road deaths
Federal Office of Road Safety, 1991

The ups and downs of attendance

Read from the chart (graph) to finish these sentences.

1. The attendance in **January** was _____ %.
2. The **difference** in the attendance between **May** and **August** was _____ %.
3. Finish the table and chart - fill in the spaces.



Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Present	44	46	46	46	47		40	39	44	47	43	48
Total	50	50	50	50	50	50	50	50	50	50	50	50
Percent		92	92	92		86	80		88			

4. Use the words from the box to finish the sentences.

The _____ attendance was in December.

From February to April the attendance was _____.

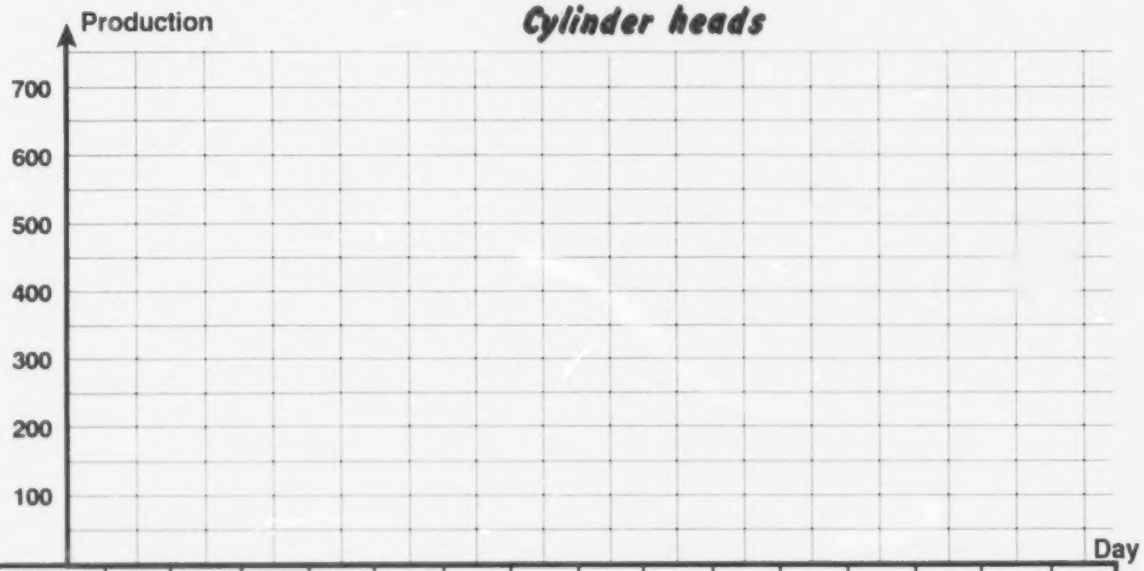
The minimum attendance was in _____.

From May to August the attendance _____.

maximum	December	constant	June	
minimum	decreased	July	increased	August

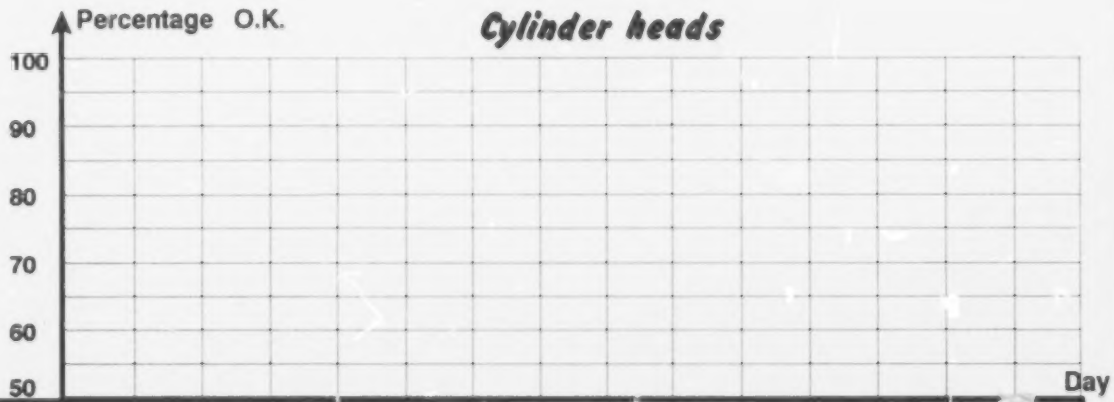
Graphing production

❶ Draw a run chart (line graph) for the production figures given.



Day:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Number produced:	600	400	300	300	350	340	640	600	540	440	340	350	360	680	470

❷ Draw a bar chart for the "*Percentage O.K.*" figures for the same 15 days.



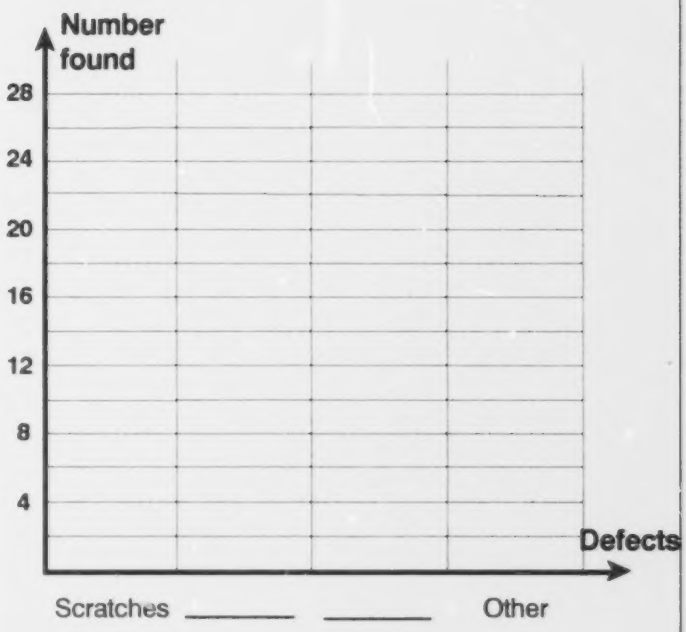
Day:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Percent O.K.:	90	93	97	97	94	97	89	90	94	95	97	97	97	88	95

Pareto plots problems

❶ 120 door panels were inspected.
The defects were:

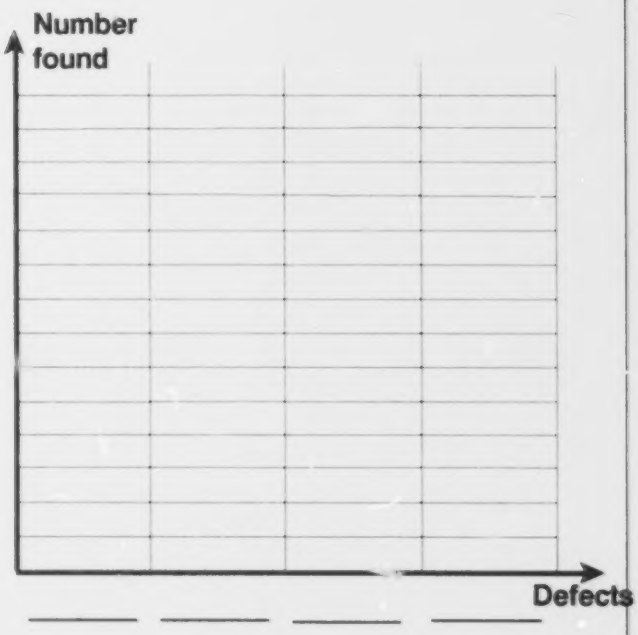
Scratches:	24
Dents	19
Paint	17
Other	14

Draw the Pareto diagram.



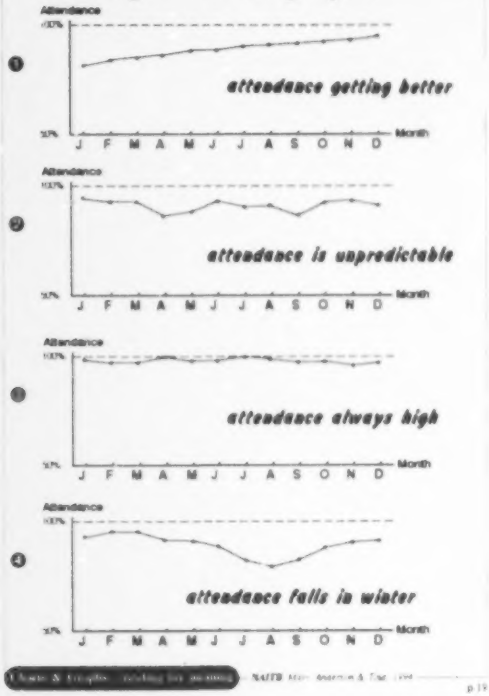
❷ Draw a Pareto diagram from this defect checklist.

Defect checklist - boot panels	
Scratches	𝍸 /// (8)
Dents	𝍸 𝍸 //// ( )
Paint	𝍸 𝍸 / ( )
Other	𝍸 / ( )



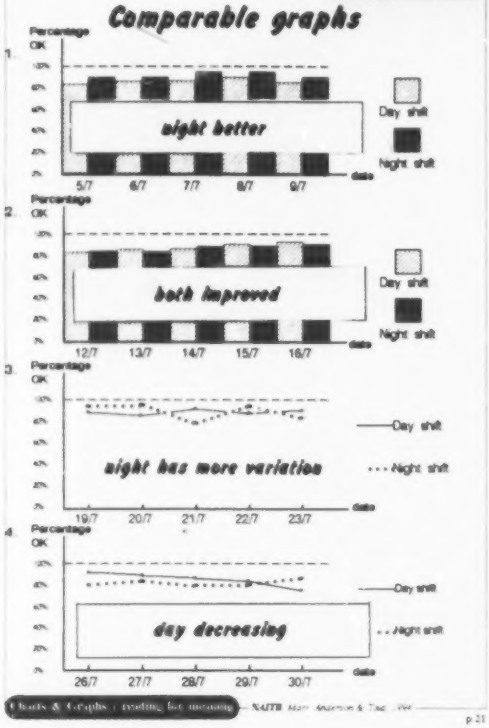
ACTIVITY SHEET

Getting a line on graphs



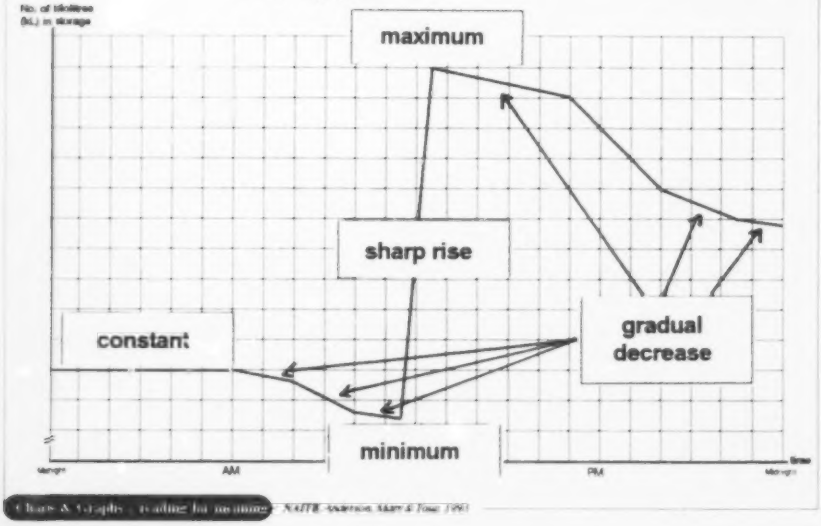
ACTIVITY SHEET

Comparable graphs



ACTIVITY SHEET

Pumping petrol 1



ACTIVITY SHEET

Pumping petrol 2 - statements

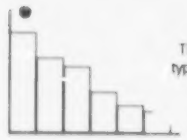
Use two words from the list below to complete each of the statements about the graph, ***Pumping petrol 2***.

- After 5 pm the slope was ***steeper / greater*** than before 5 pm.
- Between midnight and 6 am the number of kilolitres of petrol in storage was ***constant / not changing***.
- The amount of petrol was ***highest / maximum*** at 12.30 pm.
- The gradient from 6 to 8 am was ***less / smaller*** than from 8 to 10 am.
- The rise was ***sharpest / steepest*** between 11.30 am and 12.30 pm.

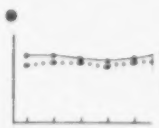
sharpest	***constant***	***steepest***	***maximum***	***less***
highest	***steeper***	***not changing***	***smaller***	***greater***

ACTIVITY SHEET

Which charts work?

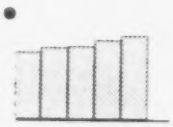


There are 6 main types of workplace accidents



This year production for the first 6 months is better than last year

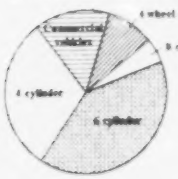
Over 6 months the quality of work has improved



ACTIVITY SHEET

Pie charts

- Button Car Factory makes the following types of vehicles.

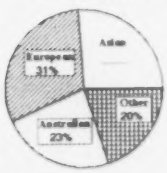


Fill in the percentages using the figures from the box below.

4 cylinder	***30*** %
6 cylinder	***40*** %
8 cylinder	***5*** %
4 wheel drive	***10*** %
Commercial vehicles	***15*** %
The total is	***100*** %

5%	10%	15%	30%	40%

- Where workers come from. These are figures from a survey.



The largest group was ***European***.

The smallest group was ***Other***.

The Asian group was ***26*** %.

Reading pie charts

1. Production workers: 59%
2. Large: 30%
3. Diesel: 26%
4. Japan: 15%
5. Excise: 37.3%
6. Drivers: 43.7%

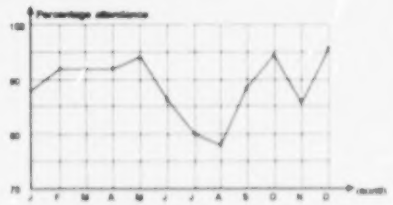
BEST COPY AVAILABLE

ACTIVITY SHEET

The ups and downs of attendance

Read from the chart (graph) to finish these sentences

1. The attendance in January was **88** %
2. The difference in the attendance between May and August was **16** %
3. Finish the table and chart - fill in the spaces



Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Present	44	46	46	46	47	43	40	35	44	47	43	46
Total	50	50	50	50	50	50	50	50	50	50	50	50
Percent	88	92	92	92	94	86	80	70	88	94	86	92

4. Use the words from the box to finish the sentences

The **maximum** attendance was in December

From February to April the attendance was **constant**

The minimum attendance was in **August**

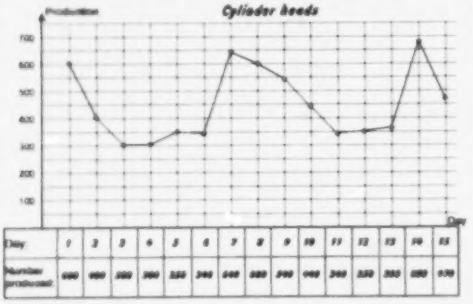
From May to August the attendance **decreased**

maximum	**December**	**constant**	**June**
minimum	**decreased**	**July**	**increased**	**August**

ACTIVITY SHEET

Graphing production

- Draw a run chart (line graph) for the production figures given



Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Number produced	600	450	300	300	320	340	540	600	540	440	340	320	350	650	470

- Draw a bar chart for the "Percentage O.K." figures for the same 15 days

Day:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Percent O.K.:	100	90	97	97	94	97	89	100	94	95	97	92	97	88	95

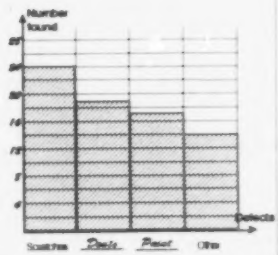
ACTIVITY SHEET

Pareto plots problems

- 120 door panels were inspected
  The defects were

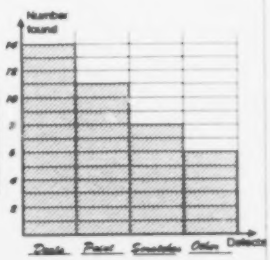
Scratches	24
Dents	19
Paint	17
Other	14

Draw the Pareto diagram.



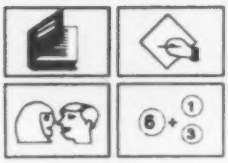
- Draw a Pareto diagram from the defect checklist

Defect checklist - boot panels	
Scratches	(8)
Dents	(14)
Paint	(11)
Other	(6)



NUMERACY ON THE LINE

Where do we start?



NATIONAL AUTOMOTIVE
LANGUAGE & LITERACY
COORDINATION UNIT

Where do we start?

Order of operations

Purpose

There is a standard order in which you have to do adding (+), subtracting (-), multiplying (x) and dividing (÷) when they are all mixed up together in a formula or a line of calculations.

These activities are designed to show the reasons behind these rules and give practice at using them with and without calculators. Calculators are very useful tools, but they need to be used carefully and effectively.

NAITB, Marr, Anderson & Tout, 1994

Background

Sometimes this order of doing the arithmetical operations may have been learnt at school or in training as the BODMAS rule. We feel that this is unnecessary, easily forgotten and confusing, and as well can be a specific problem for people whose English isn't strong.

In fact only **three main steps** need to be learnt, and using the BODMAS rule can complicate the process.

By using a familiar situation that is logical, the rules can be developed easily and quickly without the need to resort to a complicated, unfamiliar rule.

As with other activities, we believe that maths is best learnt through activities, and through talking and discussing. These notes are designed for you to adapt to your own needs and situations. Please feel free to change them and to add your own ideas and activities. In particular it makes sense to add examples from your workplace.

We have prepared some handouts for you to give to your trainees at the end as a summary of the activity. This means they don't have to take notes during the session and can concentrate on joining in and understanding the ideas.

What to prepare

You need to have available for this unit enough of the following materials for each trainee in your group:

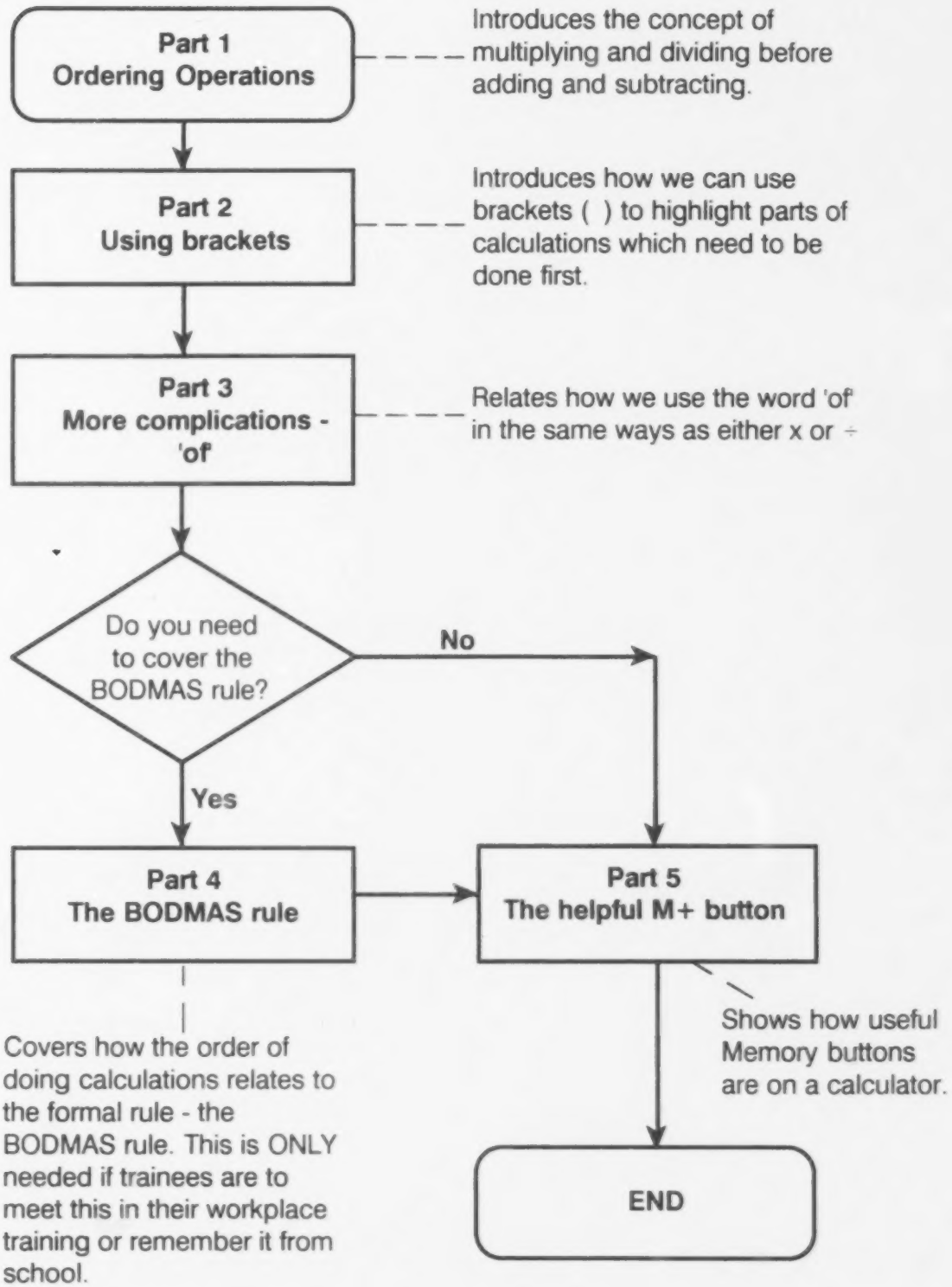
- photocopies of each Activity Sheet
  - ❑ ***Buying up the specials***
  - ❑ ***Out to lunch***
  - ❑ ***Can I pay for it?***
  - ❑ ***Sharing the cost***
  - ❑ ***More practice***
- calculators - encourage each trainee to bring their own, if they have one, otherwise a class set will be needed.

Who's it for?

This introductory unit is suitable for trainees who are in need of support in how to calculate quickly and efficently in their heads or using calculators. More advanced trainees may not need to cover all of this work, although it would be worth checking out whether they can use their Memory Buttons on their calculator, and are aware of the order of doing calculations.

NAITB, Marr, Anderson & Tout, 1994

Outline of section


Part 1
Ordering Operations
Introduces the concept of multiplying and dividing before adding and subtracting.
Part 2
Using brackets
Introduces how we can use brackets ( ) to highlight parts of calculations which need to be done first.
Part 3
More complications - 'of'
Relates how we use the word 'of' in the same ways as either x or ÷
Do you need to cover the BODMAS rule?
No
Yes
Part 4
The BODMAS rule
Part 5
The helpful M+ button
Covers how the order of doing calculations relates to the formal rule - the BODMAS rule. This is ONLY needed if trainees are to meet this in their workplace training or remember it from school.
Shows how useful Memory buttons are on a calculator.
END

NAITB, Marr, Anderson & Tout, 1994

Part 1: Ordering operations

Activity

Give out Activity Sheet - ***Buying up the specials***.
Give trainees time to solve the problems, then use the questions to begin a discussion about what they did.

Ask:

- What maths did you use?
- Which questions used what maths?
- Did you add?
- Did you multiply?
- Can you remember which came first - multiply or add?
- How can we write these sums down?

The aim here is to see that it in real situations it is natural to be able to tell where you need to multiply or to add.

Presentation

Write up some of the problems as a sum.

e.g. Question ③

$5 + 2 x $7 + 3 x $9 + 4 x $10 + $22 + 3 x $7
= $5 + $14 + $27 + $40 + $22 + $21
= $129

**Stress that you multiplied first before adding -
A rule to remember.**

Get trainees to work the same questions out using a calculator.

Ask:

- Do we get the same answers?
- If not, why not?
- How can we get the right answers?

Presentation

Give a simple example like 3 + 4 x 5 to do on the calculator. Allow a miniute or two and discuss the results.

**Points to make:
Calculators are different from each other
Calculators aren't always right - they need human input.**

NAITB, Marr, Anderson & Tout, 1994

Explain that most calculators will get an incorrect answer of 35 because they perform the operations as you enter the numbers - here the addition first, then the multiplication:

That is, in this example they add the 3 to the 4 first to get 7, then multiply that by the 5 to get 35.

The answer should have been 3 plus 20 is 23, because we needed to multiply first.

Activity

Give out Activity Sheet - ***Can I pay for it?***
Give trainees time to solve the problems, then have a discussion about what maths they used this time.

Ask:

- What calculations did you have to do this time?
- What was different from the previous sheet?
- Did you subtract or divide as well?
- Can you remember which came first this time?

Remind trainees, if necessary, that 'a half of' means the same as 'dividing by two', a 'fifth of' means the same as 'dividing by five', etc.

Presentation

Ask:

- Can we write these down as sums on one line?

Write up some of the questions as a sum.

E.g. Question ②

$2 \times \$1.88 + 2 \times \$1.28 + \frac{1}{2}$ of $\$7.98 + \frac{1}{5}$ of $\$7.98$
$= 2 \times 1.88 + 2 \times 1.28 + 7.98 \div 2 + 7.98 \div 5$
$= 3.76 + 2.56 + 3.99 + 1.59$
$= \$11.90$

Point out that we now also have to do any dividing first, along with the multiplying, and then adding last.

NAITB, Marr, Anderson & Tout, 1994

Ask:

♦ We've now seen where adding, multiplying and dividing fit in. But what about subtracting?

Ask the trainees to look at Question ③.

$20.00 - 2 X $0.95
= $20.00 - $1.90
= $18.10

20.00
- 1.90
18.10

The final point to make here is that subtracting is also done last along with the adding.

We see that to work out the change by subtraction, we also do it last - after any multiplying (and dividing).

Presentation

Now you need to pull together the work so far. The summary to date is:

When we have some adding, subtracting, multiplying or dividing to do we need to think about the order in which we do the calculations. This includes when we use our calculators.

The conclusion to this point is that there is an order in which you need to do your calculating, including how you enter calculations onto a calculator.

The order we need to follow is:

❶ Multiplications and divisions x and ÷

❷ Additions and subtractions + and −

NAITB, Marr, Anderson & Tout, 1994

Part 2: Using brackets

Activity

Give out Activity Sheet - ***Out to lunch***.
Allow trainees time to solve the problem.
Have a group discussion about how we write this down.

Ask:

- Did you write anything down?
- What did you do first?
- Did you add?
- Did you multiply?
- Can you remember which came first?

Expect different people to use different methods.

Each person's way of solving this is equally valid. You need to pull together these ideas. There are two main ways of doing this:

① **Individual items first.**
② **Work out the total of one order first.**

Presentation

Method 1 - Individual items first could be presented as:

5 hamburgers cost 5 times $3 5x$3 = $15
5 buckets of chips cost 5 times $2 5x$2 = $10
5 cans of cokes cost 5 times $1 5x$1 = $ 5
This would all add up to $15 and $10 and $5 which makes $30.

```
 15
 10
+ 5
---
 30
---
```

With the group, explore how this could be written down in one line by asking:

- How could this be written down in one line?
- How can you write down what you did in your head?

Show that this can be written down as:

5 x 3 + 5 x 2 + 5 x 1
= 15 + 10 + 5
= 30

Stress again that you multiply first before doing the adding.

The issue here is to work out how you can answer these types of questions using a one line calculation, which relates directly to using a calculator.

NAITB, Marr, Anderson & Tout, 1994

Method 2 - Working out the total of one order first could be presented as:

1 hamburger at $3 + chips at $2 + coke at $1 = $6

5 people at $6 each makes 5 lots of $6 = $30

5 x $6 = $30

3
2
+1
$6

Again explore how this could be written down in one line with the same questioning as before for Method 1.

Two possible ways to write it down that could be suggested are:

3 + 2 + 1 x 5 or *5 x 3 + 2 + 1*

Note that these two ways might be given, but they are NOT correct. Use them as the reason to use brackets.

Ask:

- If we use our rules from before what is the answer to these two sums?

The two possible answers are:

① *3 + 2 + 1 x 5 = 3 + 2 + 5 = 10*

or

② *5 x 3 + 2 + 1 = 15 + 2 + 1 = 18*

Remind trainees that you multiply first before you add.

But these are not the right answers - the total order was supposed to cost $30, as we worked out for method 1.

Logic says that these answers are wrong.
Try them on the calculator.
Again, don't be surprised at the calculator's answers either!

Possible questions:

- To get the right answer what parts of the sum do we have to do first?
- Does this mean breaking the rule of multiplying before adding?
- Do you know a way we can get around this problem, so that we can do the adding first?
- How can we write it down then so that we get the right answer of 30?

Presentation

Draw some brackets on the board.

Introduce the use of brackets -

( )

Highlight that we put brackets around the numbers we want to add first. That means we work out that part of the sum before doing the rest.

Ask:

- Does anyone know how these might help?
- Where should we put in brackets in this question?

Put in brackets:

(3 + 2 + 1) x 5 or *5 x (3 + 2 + 1)*

6 x 5 or *5 x 6*

30 or *30.*

Reinforce that sometimes we need to use **brackets** to highlight which bits of a sum we should do first - even before using the rule of multiplying and dividing before adding and subtracting.

Emphasise:
Brackets are done before multiplying and dividing.

Present another example to solve:
5 x (4 + 3 + 5) - (12 + 6 + 2) ÷ 4
Ask trainees to try this themselves before solving it together.

Solution:

5 x (4 + 3 + 5) − (12 + 6 + 2) ÷ 4

= 5 x 12 − 20 ÷ 4

= 60 − 5

= 55

❶ Do the brackets first - so add the numbers in the brackets

❷ Now do the multiplying and dividing before the adding and subtracting

❸ Finally do the taking away

NAITB, Marr, Anderson & Tout, 1994

Part 3: More complications: 'of'

Presentation

There is an added complication in maths calculations: the word 'of'. We met it earlier when we were doing the problems with the shopping lists.

Have another look at the Activity Sheet - ***Can I pay for it?***.

Explain that when we solved Question ❷ we used the word '**of**'.

2 jars of Pasta sauce at $1.88 which works out as 2 x 1.88
and 2 kg of tomatoes at $1.28 which works out as 2 x 1.28
and $^1/_2$ kg of steak at $7.98 which works out as 7.98 ÷ 2
and $^1/_5$ kg of silverside at $7.98 which works out as 7.98 ÷ 5

The main point to bring out in the discussions is that we have already been using the word 'of', but we've turned it into either a multiply (x) or a divide (÷).

Treat the 'of' just like a times (multiply) or a divide. Remember: multiply, divide and 'of's are done FIRST before adding and subtracting

Activity

Give out Activity Sheet - ***Sharing the cost***.
Give trainees time to solve the problem.

Ask:

- What calculations did you have to do this time?
- Which came first this time?
- Can we write this down as a sum on one line?

Presentation

Stress that the important point this time is that we have to do the dividing (or sharing) by 5 right at the end, and do the other adding and multiplying first. We can either use brackets or the long line that stands for division to highlight that we need to work out the top line first.

Introduce the idea that the long line that stands for division can be used like brackets.

NAITB, Marr, Anderson & Tout, 1994

Represent the question like:

$(3 \times 3 + 4 + 4 + 2 \times 1.50 + 3 \times 1 + 2 \times 1.50) \div 5$

$= (9 + 4 + 4 + 3 + 3 + 3) \div 5$

$= 26 \div 5$

$= \$5.20$

or

$$\frac{3 \times 3 + 4 + 4 + 2 \times 1.50 + 3 \times 1 + 2 \times 1.50}{5}$$

$$= \frac{9 + 4 + 4 + 3 + 3 + 3}{5}$$

$= \$5.20$

Highlight that when division is involved we can use either brackets or the long line that acts as brackets.

Either way the shared cost is $5.20 each

Extension

Discuss where else trainees have come across these type of calculations. If trainees have calculated averages then you could look at the formula for averages. Or refer to others like:

$$\%FTB = \frac{\text{\# OK parts (No Rework)}}{\text{Total \# of parts}} \times 100$$

Conclusion

Pull together the rules developed so far. That is, there is an **order** in which we have to do our calculations:

If you do not need to cover the more formal BODMAS rule, sum up the rules to this stage for the order of operations.

❶	First:	**Brackets**	( ) and ———
❷	Second:	**Of**'s, **multiplies** and **divides**	**of**, **x**, ÷
❸	Last:	**Adding, subtracting**	+, –

Only introduce the formal BODMAS rule if trainees have met it before and want to understand it.

Part 4: The BODMAS rule

Ask:

- Do you remember these rules from school?
- Have you heard of the **BODMAS** rule?
- How do these rules match the BODMAS rule?

Use Summary Sheet - ***The BODMAS rule***, as a handout if trainees need to know about the BODMAS rule.

Practice

Give out the Sheet ***More practice***, and give trainees time to work out the problems.

Use your own problems and applications if possible,
or
ask trainees to think of their own problems where these types of calculations come up.

Part 5: The helpful M+ button

Discussion questions:

- Have you ever used the **M+** button?
- What do you think it means?
- What other **M** buttons are there, and what do you think they mean?

Helpful calculator buttons are:
M+ adds to memory
M- subtracts from memory
MR recalls the answer from the memory
MC clears the numbers out of the memory

Get trainees to try the calculation below without using a calculator.

5 x 3 + 4 x 7 + 2 x 9

Now ask them to use their calculator, and check their methods.

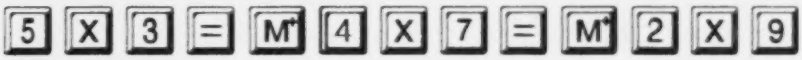
Ask:

- How did you use your calculator?
- Did you need to write anything down?

Explain that using the M+ button is a powerful way of using a calculator without having to write anything down. It can be useful if you were, say, adding up around a supermarket or in a stocktake where its better not to have to use a pen as well.

An important and relevant use here of the M+ button is when you are keeping a running total - as in the shopping examples

Show that this would be entered on a calculator like:



Activity

Ask trainees to solve the problems on the Activity Sheets - ***Buying up the specials*** and ***Can I pay for it?*** using their M+ on the calculator.

Remind trainees to press the = button after each multiplication, then press the M+ button to add it to the running total.

Possible questions:

- Can you think of other uses for M+?
- Could you use it at work?

To stress how this relates to the workplace brainstorm ideas and applications of where you could use M+ from the workplace.

You may need to collect some of the statistics/record keeping sheets or calculations that are used around your workplace that involve calculations, and see how many of these could be made easier by the use of the M+ button.

Extension Activity

Get trainees to work in pairs with different supermarket, or other, catalogues. Ask them to select ten items they would like to buy, estimate the total cost of these and record the estimate.

Then work out the total cost accurately using a calculator.

Remember to encourage the use of estimation - because the use of calculators without estimation can lead to ridiculous answers.

Ask them to imagine they have $100 to spend - can they afford to buy these items and if so how much change would they get? If not, how much more money would they need?

Your notes and ideas

NAITB, Marr, Anderson & Tout, 1994

Buying up the specials

Using the hardware catalogue items, **how much would it cost to buy**:

❶ **2 Compact double adaptors**
3 White light tubes, and
3 cans of **Holts Dupli Colour Auto spray**?

❷ **3 Garden taps**
4 Stack N Nest cubes
2 Green Lattices, and
1 20m Extension lead?

❸ **1 Elite window washer**,
2 Selleys All Clear,
3 Coir door mats,
4 Circuit breakers,
1 Hills Laundry Trolley, and
3 Stack N Nest Cubes?

Can we do these with a calculator? How?

Buying up the specials

Can I pay for it?

Using the specials on the Coles advertising brochure, can you work out these problems?

❶ How much would it cost to buy **500g** of **Coon Tasty Cheese**, **2 packets** of **Vita Brits** and **half a kilogram** of **thin sausages**?

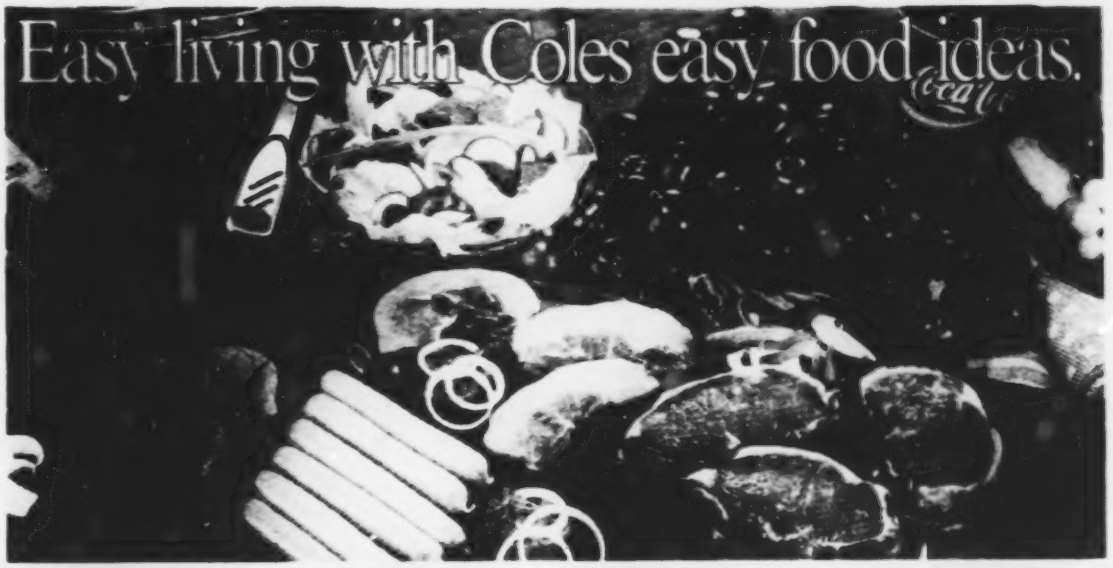
❷ How much would it cost to buy **2 jars** of **Dolmio Pasta sauce**, **2 kg** of **tomatoes**, **half a kg** of **porterhouse steak** and a **fifth of a kg** of **sliced silverside.**

❸ If I paid for **two packets** of **spaghetti** and paid with **$20**, how much **change** would I get?

❹ If I only have **$25**, could I buy **2 kg** of **thin sausages**, **half a kg** of **Pork leg steaks**, **I kg** of **porterhouse steak**, **500 g** of **Coon tasty cheese** and **2 litres** of **Berri Cordial**?

Check your answers with your calculator.
Remember though - don't always trust your calculator.

Can I pay for it?

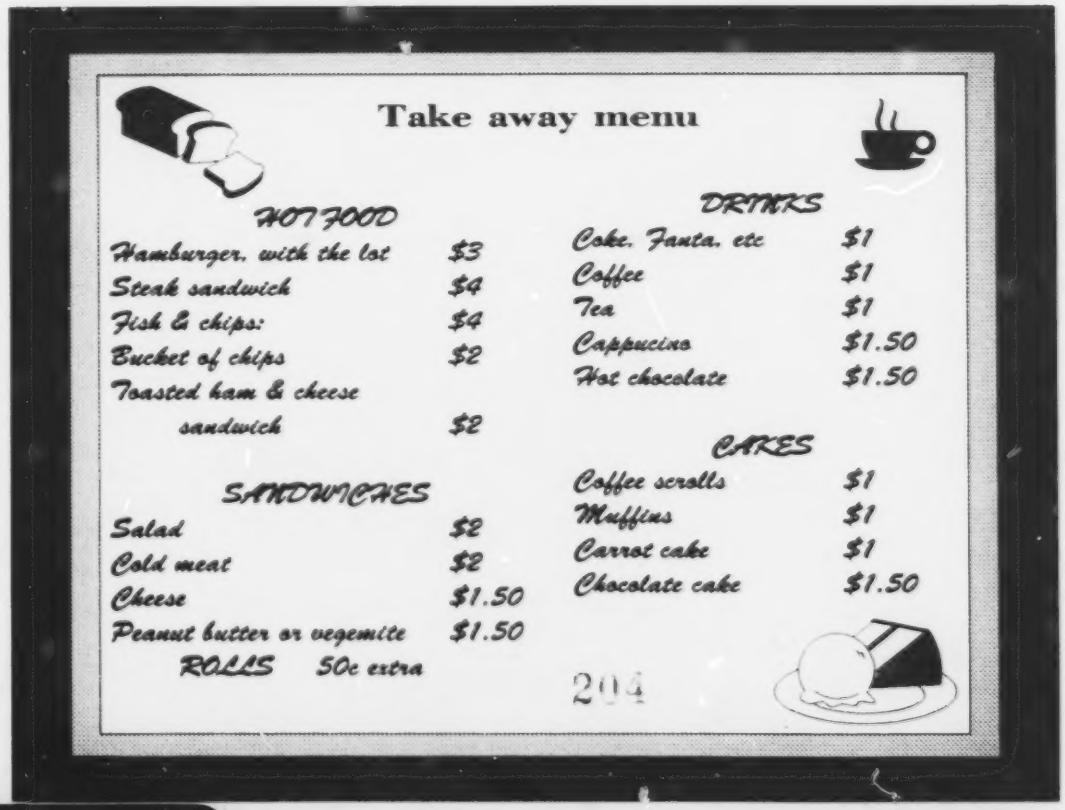


Out to lunch

A family of five went out for lunch one day. Each person had a hamburger, a bucket of chips and a can of coke.

How much did this cost altogether?

How did you work it out? Try to write it down in words or numbers.



Take away menu

HOT FOOD

Hamburger, with the lot	$3
Steak sandwich	$4
Fish & chips:	$4
Bucket of chips	$2
Toasted ham & cheese sandwich	$2

SANDWICHES

Salad	$2
Cold meat	$2
Cheese	$1.50
Peanut butter or vegemite	$1.50

ROLLS 50c extra

DRINKS

Coke, Fanta, etc	$1
Coffee	$1
Tea	$1
Cappucino	$1.50
Hot chocolate	$1.50

CAKES

Coffee scrolls	$1
Muffins	$1
Carrot cake	$1
Chocolate cake	$1.50

204

Sharing the cost

Five friends had lunch together. They shared the cost evenly between them. Altogether they had:

3 hamburgers
I steak sandwich
I fish and chips
2 pieces of chocolate cake
3 cans of coke and
2 cappuccinos.

How much did each pay?

Take away menu

HOT FOOD

Hamburger, with the lot	$3
Steak sandwich	$4
Fish & chips:	$4
Bucket of chips	$2
Toasted ham & cheese sandwich	$2

SANDWICHES

Salad	$2
Cold meat	$2
Cheese	$1.50
Peanut butter or vegemite	$1.50

ROLLS 50c extra

DRINKS

Coke, Fanta, etc	$1
Coffee	$1
Tea	$1
Cappucino	$1.50
Hot chocolate	$1.50

CAKES

Coffee scrolls	$1
Muffins	$1
Carrot cake	$1
Chocolate cake	$1.50

The BODMAS Rule

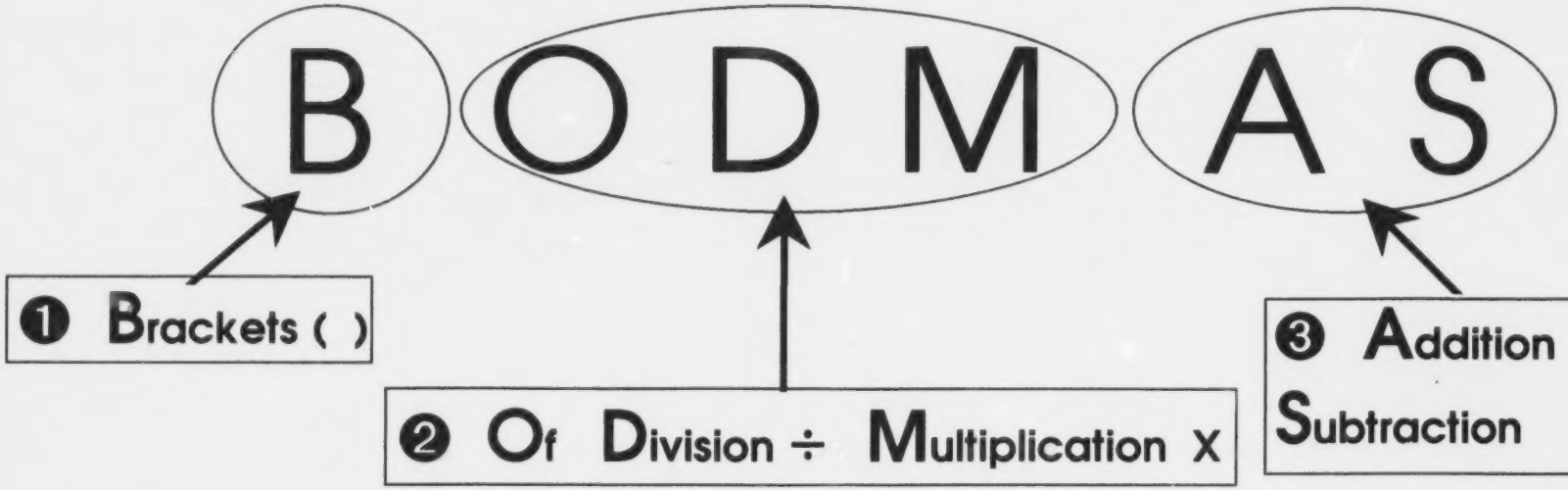
The **order** in which we have to do our calculations:

❶	First:	**Brackets**	**( ) and** _____
❷	Second:	**Of's, multiplies** and **divides**	**of, x, ÷**
❸	Last:	**Adding** and **subtracting**	**+, -**

Example:

$$\%FTB = \frac{\text{\# OK parts (No Rework)}}{\text{Total \# of parts}} \times 100$$

You may know this as the **BODMAS** rule:



Example:

$$\text{Average} = \bar{x} = \frac{\text{Sum } (x_1 + x_2 + x_3 + \ldots . x_n)}{n}$$

206

Example:

$5 \times 3 + 5 \times 2 + 5 \times 1$
$= 15 + 10 + 5$ *multiply first*
$= 30$ *then add*

207

Buying Up the Specials

❶ 2 x $3 + 3 x $2 + 3 x $5
= $6 + $6 + $15
= $27

❷ 3 x $6 + 4 x $7 + 2 x $20 + $15
= $18 + $28 + $40 + $15
= $101

❸ $5 + 2 x $7 + 3 x $9 + 4 x $10 + $22 + 3 x $7
= $5 + $14 + $27 + $40 + $22 + $21
= $129

Can I Pay For It?

❶ $3.98 + 2 x $1.88 + $2.98 ÷ 2
= $3.98 + $3.76 + $1.99
= $9.73

❷ 2 x $1.88 + 2 x $1.28 + $7.98 ÷ 2 + $7.98 ÷ 5
= $3.76 + $ 2.56 + $ 3.99 + $ 1.49
= $11.80

❸ 2 x $0.95=$1.90$20 - $1.90 = $18.10

❹ 2 x $2.98 + $8.98 ÷ 2 + $7.98 + $3.98 + 2 x $2.28
= $5.96 + $4.49 + $7.98 + $3.98 + $4.46
= $26.87

No, $25 is not enough.

Out to Lunch

$5 \times \$3 + 5 \times \$2 + 5 \times \$1$ **or** $\$3 + \$2 + \$1 = \$6$

$= \$15 + \$10 + \$5$ $5 \times \$6 = 30$

$= \$30$

Sharing the Cost

$$\frac{3 \times \$3 + \$4 + \$4 + 2 \times \$1.50 + 3 \times \$1 + 2 \times \$1.50}{5}$$

$$= \frac{\$9 + \$4 + \$4 + \$3 + \$3 + \$3}{5}$$

$$= \frac{\$26}{5}$$

$= \mathbf{\$5.20}$

or

$(3 \times \$3 + \$4 + \$4 + 2 \times \$1.50 + 3 \times \$1 + 2 \times \$1.50) \div 5$

$= (\$9 + \$4 + \$4 + \$3 + \$3 + \$3) \div 5$

$= \$26 \div 5$

$= \mathbf{\$5.20}$

What averages mean

NATIONAL AUTOMOTIVE
LANGUAGE & LITERACY
COORDINATION UNIT

What averages mean

Purpose

The activities in this section are designed to clarify the concept of averages. They aim to go beyond a set of learned arithmetic procedures, and to ensure averages are quantities that are understood, and can be estimated, used, and interpreted in a meaningful way.

The section also includes discussion and practice sheets which focus on the ways in which averages can be used to make predictions, or to monitor output, costs or sales over extended periods of time.

The final part of this section provides practice at calculating averages as they are encountered in typical workplace charts for attendance and production, including control charts.

NAITB, Marr, Anderson & Tout, 1994

Background

Active learning experiences

The first activity in this section asks trainees to participate actively in a mock task using concrete objects - jelly beans, blocks, or workplace objects - in order to visualise what we mean by an average.

Physical objects are used for this activity so that the arithmetical process involved in averaging can be acted out or modelled using the actual objects. The active involvement or experience should help the learner to understand and remember the concepts far more than if they had merely sat passively listening to a trainer or teacher do all of the talking.

Workplace trainers will know that, in the factory, hands on experience, or doing it yourself, is basic to all training and learning. The learning of mathematics should not be different. Using hands-on materials in teaching maths to adults encourages visualisation and the understanding of ideas and mathematical rules. By manipulating concrete objects, students learn by exploration and discovery, and become active in their own learning. This seems the best way to distance students from the realms of the 'mystifying magic tricks' that maths teachers displayed to them when they were at school. Teachers who try the hands-on approach with adults, have consistently been rewarded with cries of "I see", "Now it makes sense" or "Why didn't they do it this way at school?" So the effort of cutting out bits and pieces and using concrete materials is worthwhile and important.

As we have said before, many teachers and trainers involved in adult education were the victims of similar educational methods as their students. Having learnt maths using traditional paper and pencil methods they may not feel very confident with alternative approaches. Trainers using hands-on materials for the first time may also fear the reaction from trainees when they produce materials and active experiences which they may think belong in the kindergarten! But it is important to overcome these initial reservations. Once you have used them and seen how effective they are, alternative active approaches will become a valuable part of your training.

Estimations and calculators

Calculators are used extensively in workplace calculations because real measurements and workplace data do not come as simple, whole numbers, which can easily be manipulated in the head. They may come as high numbers with many figures or as decimals. For speed and accuracy calculators are used.

However, a consequence of the increase in speed provided by calculators is the increased likelihood of foolish errors. These are caused through the pressing of a wrong button, not pressing buttons hard enough, or mistakenly entering numbers more than once. Sometimes decimal points are left out, or the equals button may be pushed when not needed, causing calculations to be done twice over. Also + - x ÷ buttons pushed in the incorrect order can lead to very wrong results.

NAITB, Marr, Anderson & Tout, 1994

One remedy to such possible mistakes is to use "common sense" at the same time as using the technology. Always make sure that you are aware of the approximate results you expect, so that you will spot and be able to check an obvious mistake. Because average calculations involve so many entries as well as two arithmetical operations, addition and division, they can be particularly prone to mistakes. If a person is blindly following rules or a formula they are unlikely to notice a wrong final answer. However, if they are aware of an expected approximate outcome, errors can be spotted more easily.

In this section we encourage estimation of all averages before using a calculator. This estimation, of course, depends on a thorough understanding of what an average is, and what effect remarkably higher or lower figures will have on it. These concepts are addressed by the activities presented, and should be kept in mind for all calculations.

What to prepare

Part 1 - Acting it out

For the activity - ***The mean jelly bean*** each trainee will need a copy of ***The mean grid*** (photocopy this onto coloured cardboard if possible) and a quantity of jelly beans or similar items in plastic cups or containers.

Part 2 - Using averages to make predictions

If trainees do this optional part, each trainee will need a copy of the practice sheet:

❑ ***Using averages***

Part 4 - Distortion of averages

For the activity ***The highs and lows of averaging*** photocopy the ***Average wages*** (p. 29) onto light coloured cardboard, and cut up into cards. Each trainee will need **one** card only. Only one managers card is to be included, and there should be a higher number of production worker level 1 cards than any other cards. Place into a labelled envelope or plastic bag.

Each trainee will need a copy of:

❑ ***Averages - Data sheet***

❑ ***About averages - part 1***

❑ ***About averages - part 2***

NAITB, Marr, Anderson & Tout, 1994

Part 5 - Averages and ranges in workplace charts.

Each trainee will need a copy of:

- ❑ ***Average production figures - part 1***
- ❑ ***Average production figures - part 2***

Each pair of trainees will need a copy of

- ❑ ***Control charts***

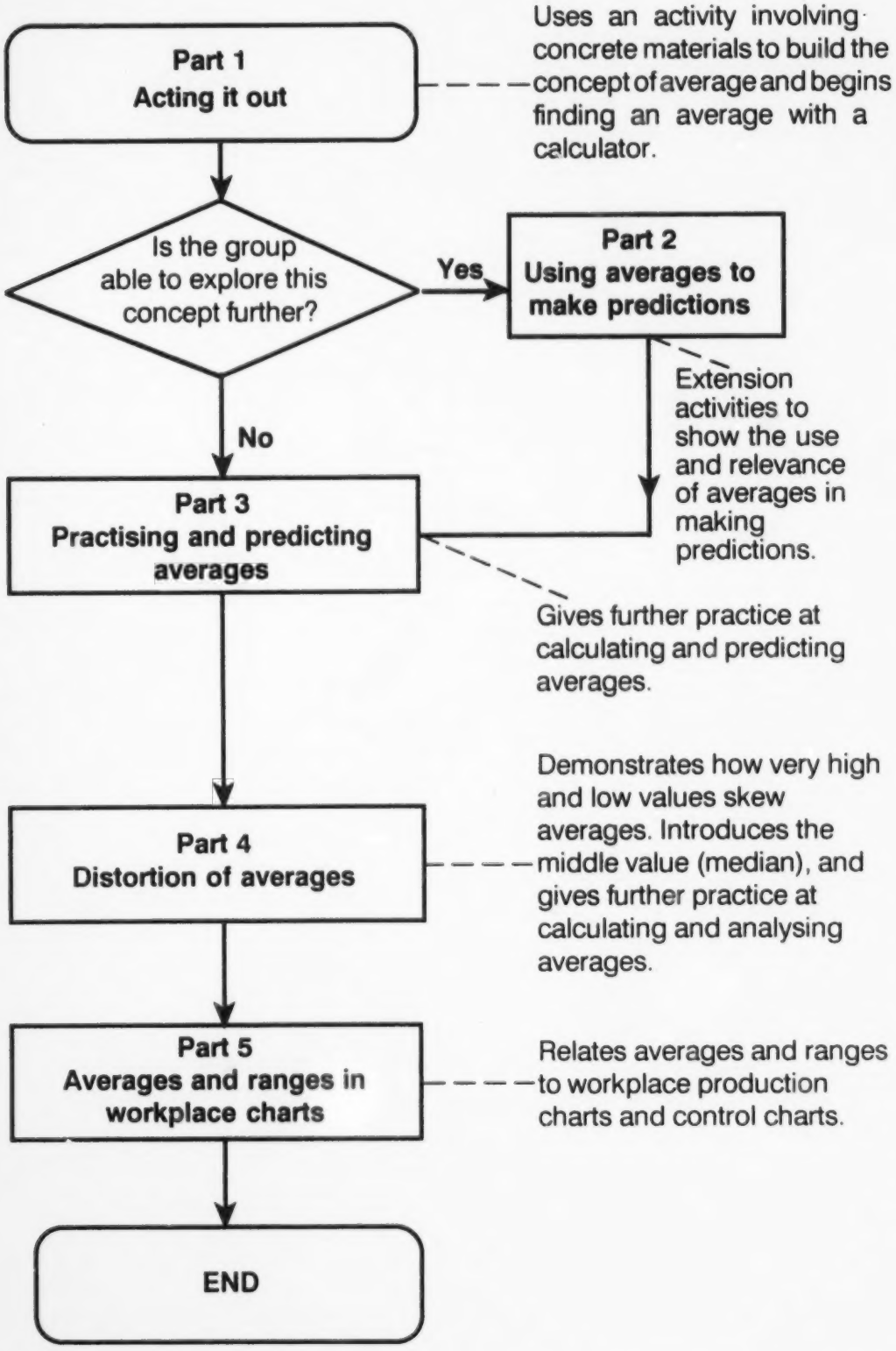
Each pair will also need a set of the ***Control charts cards***. These should be photocopied onto coloured cardboard and cut out and stored one set per envelope.

It would also be useful to have overhead transparencies of the charts from:

- ❑ ***Average production figures - part 1***
- ❑ ***Average production figures - part 2***
- ❑ ***Control charts***

NAITB, Marr, Anderson & Tout, 1994

Outline of section


Part 1
Acting it out
Uses an activity involving concrete materials to build the concept of average and begins finding an average with a calculator.
Is the group able to explore this concept further?
Yes
Part 2
Using averages to make predictions
No
Extension activities to show the use and relevance of averages in making predictions.
Part 3
Practising and predicting averages
Gives further practice at calculating and predicting averages.
Part 4
Distortion of averages
Demonstrates how very high and low values skew averages. Introduces the middle value (median), and gives further practice at calculating and analysing averages.
Part 5
Averages and ranges in workplace charts
Relates averages and ranges to workplace production charts and control charts.
END

NAITB, Marr, Anderson & Tout, 1994

Part 1: Acting it out

Activity - The mean jelly bean

Give out a copy of ***The mean grid*** and a cup of jelly beans, or other similar items, to each trainee.

Presentation

Say:

- Take one of the jelly beans, from the cup and place it in a grid square so that it does not touch any of the lines.
- Then take another, leave one space on the grid, and place it in the next square.
- Continue like this, placing as many beans as you can, for a time of one minute which I, (the trainer) will time. I want you to do as well as you possibly can at this.

At the end of the minute, collect the cups of left over jelly beans and ask all trainees to look around the room and compare the numbers (just by sight at present).

Ask:

- Who seems to have the most?
- Who seems to have the least?
  - Were these more carefully placed? (better quality, less quantity?)
- Roughly. what is the difference between highest and lowest?

Since the task is not serious, encourage jokes, but not at the expense of anyone vulnerable.

- Who has about a middle amount?
- What are some of the reasons for differences?
- If we all now wanted to eat the jelly beans on the table, would this be a 'fair' way of distributing them?
- If we wanted to make sure everyone got the same amount from the beans on the table, how could we do it? (Encourage discussion of pooling them all and sharing out).
- Suppose now, we put them all in the middle and shared them out. Guess how many each person will get?

NAITB, Marr, Anderson & Tout, 1994

Ask each person to record their guess privately onto a piece of paper.

Before pooling all of the beans however, ask each person to count, and record, the number of beans they have on the white board. (Names are not necessary).

At this stage, with the numbers on the board, ask if anyone wishes to revise their guess. If so, they should write down the new guesses.

The rate at which you progress now depends on the experience and knowledge of the group members. They may all now tell you to work out an average, or to add them together, then divide. However, it is quite likely that many will not, and the notion of an average needs to be made very clear to those people.

The aim is to get trainees to understand the idea of average as an equal share. Act out the pooling, or sharing process. Then discuss how it could be done mathematically:

- putting all the beans in the centre, is combining or adding
- sharing out is dividing.

Get trainees to add the column of figures on the board using calculators.

Record and compare totals - allowing time for checking if there is disagreement.

Now discuss how to do the division process on the calculator.

Acting out can also be very beneficial when the average is not a whole number - the group will have had to make a decision about cutting, or discarding the left overs. This can then be compared to the decimal result in the average . It is very likely there will be one.

Ask:

- ♦ Which number goes in the calculator first?
- ♦ What symbol do we use?
- ♦ What do we divide by?
  Make sure everyone knows you must divide by the number of people in the group.

To finish off, compare the number of beans each trainee received when you acted out the process to the number calculated, and finally, to the numbers guessed, or predicted.

NAITB, Marr, Anderson & Tout, 1994

Discuss or reinforce with the group that this quantity, which is an equal share for all, is called '**The Average**'. Ask if they know the equivalent word for 'average' in their own languages and record some of these on the board.

Tell trainees that we also call the average value the mean.

Another concept that you can discuss here is that of "**The Range**" which is the difference between the lowest and highest figures.

Ask:

- What was the lowest number of beans we had put out?
- What was the highest number of beans we had?
- What was the difference between the highest and the lowest?
- Do you know what we call this figure?

Explain that this figure, the range, is also often used at the same time as averages, especially in control charts.

Encourage discussion about how averages and ranges are used. This could be done as a whole class - if the group is small enough - or by pairs or small groups discussing the questions amongst themselves and comparing ideas.

Several suggestions are given in the following discussion outline. A few of the ideas may go beyond the capabilities of some groups but should be of interest to many others. Use your discretion on how far you can encourage your trainees to think about these aspects.

Optional Discussion

Ask:

- Who uses averages?
- Do you know how they are used in your workplace?
- If our average jelly bean number had been ____, how many beans would we have shared?

Insert a number 10 higher than your average.

NAITB, Marr, Anderson & Tout, 1994

Part 2: Using averages to make predictions

Activity

Begin this activity with a preliminary discussion and a calculation which could be done with averages as follows:

Ask:

- An 'average' worker, Lan, assembles 9 products every hour. How many will she assemble in one eight hour shift?
- Imagine 5 'average' workers exactly the same as Lan. How many products will they produce in the shift?
- Is anyone exactly an 'average' worker?
- If not, does that mean that calculations like this are useless?
- What is the approximate average number of _____ we make here in a day/hour?
- If you made this average of ___ each day/hour, how many would you make in a week/day?
- Does this mean you make exactly the same number each day/hour?
- Are calculations like this useful for anyone?
- Who would use them?

Insert a relevant product and time frame eg. bumper bars per hour, cars per day

Insert the number for the product given in the above question.

Averages assist companies to predict outputs, times, costs etc.

The next part of this activity looks at how averages can save time in calculations and provide accurate predictions.

Ask these questions to the whole group and get them to do the calculations for you to record.

If language is a problem try to have trainees sitting in groups so that one person with better English can translate to others of the same language grouping.

Say:

- Suppose 5 workers in a team have different rates of working. They assemble steering wheels.

Write on the middle of the board.

Le Mai	*makes*	*11*	*per hour*
Huang	*makes*	*9*	*per hour*
Yasmine	*makes*	*12*	*per hour*
Sebahat	*makes*	*8*	*per hour*
Wendy	*makes*	*10*	*per hour*

Now divide the rest of your board into two sections, one to record **Method 1**, the other to record **Method 2**.

Record calculations and answers as you go.

Method 1
Ask:

- How many would each person make in an eight hour shift?
- How many would the whole team make in a week (5 shifts)?

Some of the group may suggest an alternate way of doing this calculation: adding the number for the whole group for one hour then multiplying by eight then by five. Try this also if it is suggested. The answer would be the same.

Method 1				*Method 2*
Le Mai	*11/hr*	*88/shift*	*440/week*	
Huang	*9/hr*	*72/shift*	*360/week*	
Yasmine	*12/hr*	*96/shift*	*480/week*	
Sebahat	*8/hr*	*64/shift*	*320/week*	
Wendy	*10/hr*	*80/shift*	*400/week*	
Total			*2000/week*	

Method 2
Ask:

- What is the **average** for the team per hour?
- If everyone produced at the average rate, how many would the whole team make in an hour?
- How many would they make in an eight hour shift?
- How many would the whole team make in a week (5 shifts)?

NAITB, Marr, Anderson & Tout, 1994

Now compare the answers of **Method 1** and **Method 2**.
They should be the same.

	Method 1			Method 2
Le Mai	11/hr	88/shift	440/week	Average for 1 person = 10/hr
Huang	9/hr	72/shift	360/week	For the whole team:
Yasmine	12/hr	96/shift	480/week	5 people = 5 x 10 = 50/hr
Sebahat	8/hr	64/shift	320/week	shift of 8 hours = 8 x 50
Wendy	10/hr	80/shift	400/week	= 400/shift
				week of 5 shifts = 5 x 400
Total			2000/week	= 2000/week

Review what you did using the following guide.

Say:

- In **Method 1** we calculated **separately** for each person.
- In **Method 2** we worked out the average and **then** calculated for the shift and then the week.
- The results were the same.

Discuss the implications using these questions.

The idea here is to highlight that averages can make calculations quicker and simpler

Possible questions:

- Which method was quicker?
- Would using averages be a reliable way to do calculations?
- Does it matter that no-one is exactly average?

Hand out Practice Sheet ***Using averages***. Ask trainees to either complete the work in class or you can let them use it as practice at home.

NAITB, Marr, Anderson & Tout, 1994

Part 3: Practising and predicting averages

Presentation

To consolidate the arithmetical steps involved in calculating averages, ask the group to calculate some averages about themselves, first making their individual predictions.

Predicting the average first will ensure that the answers to calculations are always related back to a meaningful quantity using a reasonable prediction. This will go a long way to eliminating silly calculator mistakes.

Choose from these quantities or invent your own.

- The average age of the group
- The average height of the group (all can measure their heights in centimetres)
- The average number of times the group members can click their fingers/tap their left foot etc, in 30 seconds
- The average number of people in their families
- The average time it takes to get to work
- The average distance travelled to work.

For each average to be calculated:

- Trainees write an initial guess or 'prediction'
- You, the trainer, collect individual figures or measurements on the board
- Trainees modify their guess if they wish
- All calculate the average using a calculator
- Compare answers to individual calculations
- Compare answers to initial estimates or guesses
- All calculate the range
- Compare individual calculations of ranges.

Part 4: Distortion of averages

Activity - The highs and lows of averaging

This activity is designed to highlight how one particularly high or low figure can distort a calculated average, or mean, and give a false impression.

NAITB, Marr, Anderson & Tout, 1994

Hand to each person in the group **one** card from ***Average wages*** (p.29). Preparation instructions are in the front of this section (p.3). Ensure that only one of the Manager's cards is given out.

Ask each class member to read quickly what their card says. You can either record these salaries individually or wait until they are all read out and then summarise the information - recording as shown below.

Ask:

- What's the salary for level 1?
- What's the salary for level 2?
- What's the salary for level 3?
- What other salary level was there?
- What do you predict the average might be? (everyone should record their guess privately).

Now collect more details by asking how many people we have at each level.
Record on the board as you go.

	Salary	Number of People
Level 1		
Level 2		
Level 3		
Manager		

Looking at the information on the board, ask the group if they can see a quick way to work out the averages.
Someone may volunteer the idea of doing it in subtotals as shown:

	Salary	Number of People	Subtotals (optional)
Level 1	$430	3	3 x 430 = 1290
Level 2	$440	2	2 x 440 = 880

NAITB, Marr, Anderson & Tout, 1994

If this is not suggested, stick with the basic method and write down each salary separately:

$430 + $430 + $430 + $440 + $440 + ...

Make sure that the number of people is counted when doing the division for the average.

Compare results of calculations with the original guesses and discuss:

Possible questions:

- Is the figure higher or lower than expected? Can you think why?
- Whose salary card is higher than the average?
- Whose salary card is lower than the average?
- Does this seem right?

It will be clear that most people in the group will have a salary lower than the average.

Then ask everyone to line up in order from lowest to highest. Decide which person is in the middle.

Use 1/2 way between the middle two people if there is an even number in the group.

After writing the **average** on a piece of paper, position yourself in the line at the appropriate position for the average.

Discuss how many are higher up than average and how many are lower.

Possible questions:

- Is the average salary the same as the middle salary?
- If not, why not?
- If we worked out a real average wage for this plant or factory do you think it would be in the middle? If not, where might it be?

In this activity the high salary of the manager takes the average higher than the middle.

Now it is time to look in more detail at the effect of the manager's salary.

Say:

- Let's leave the manager out of this now.
- What do you predict the average will be without her/him?

Record a few guesses.

Repeat the calculations without the manager's salary.

Ask:

- What should we divide by this time?

  Answer: should be one less than before because there is one less person - the manager.

Discuss the results.

Possible questions:

- Is it what you predicted?
- Is it very different from before?
- How does it compare with the middle value now?
- What difference does the high salary of the manager make?

Relate these ideas back to the concrete example of the jelly beans - some had more, some less than average. A very high number either pushes the average up or is compensated by a very low number.

Say:

- Recall the jelly bean experiment. If someone had put out, say 60 jelly beans, how would it affect the average we calculated?
- In production, if you went much slower for a few hours in the morning, what would happen to your average?
- How could you stop it changing?

  Answer: If production slows down for a while the average can be kept the same by speeding up later.

Note: The middle value is called The Median - it is often used to describe house values. It gives a better indication of the market than the common Average (or mean) which is distorted by the few very expensive houses

Activity - About averages

This activity can be used either as a practice sheet for individuals - to reinforce the ideas introduced in the ***Highs and Lows of Averaging*** activity - or as an alternative classroom activity. It has an emphasis on reinforcing and developing the comparative language associated with averages. If using it as a group activity the following presentation notes should assist you.

NAITB, Marr, Anderson & Tout, 1994

Presentation

Hand out a copy of the ***Averages - data sheet*** to each trainee.

Say:

This sheet contains some information we will use to think about averages.

To familiarise trainees with the sheet

Ask:

- Who is the tallest?

  Answer: Mike

- Who is the oldest?

  Answer: Rita

- Who earns the lowest amount of money each week?

  Answer: Con and Mike

Now hand out the Practice Sheet ***About averages - part 1*** to each trainee. Ask trainees to use the sheet to write the heights, ages and wages in order. Check there is agreement about ordering before discussing the averages.

Ask:

- Without calculating, what do you think is the average height? - Circle one of the given numbers.

Discuss the choices they made and record some or all of these guesses on the board.

Repeat this process for ages and wages. Distribute calculators to each trainee to enable them to actually calculate the average height, age, and wage.

Allow time for this to be done and move around to offer help. Compare answers and refer back to their guesses on the board using the following discussion points.

Possible questions:

- Are you surprised by any of the actual answers?
- Which ones?
- Why do you think they are different from your guesses?

Ensure that the effect of very high figures in the data is discussed.

NAITB, Marr, Anderson & Tout, 1994

Now distribute the Practice Sheet ***About averages - part 2*** and explain to the trainees that they need to use the averages they have just calculated to answer questions on this sheet.

Check their answers by comparing the words or names they used in each sentence. For question 2 you could ask trainees to say or show their sentences to the person beside them and see if they agree with what's written. Ask for a selection of sentences from the group as a whole for discussion.

Presentation

Ask:

- ♦ Is the average always the same as the middle value?
- ♦ Which one of these three - height, age and wage - had the biggest difference between the middle number and the average?

  Answer: wages
- ♦ Why did it have such a big difference?

  Answer: Ali's wage was so much higher than the others.

If the ***Highs and Lows*** Activity has not been done discuss this further as follows.

Ask:

- ♦ What would be the average wage if Ali's wage was not included? - Guess first then check.

  Answer: $442.50

Allow time for trainees to do this on calculators.

The discussion should emphasize that the average is not always close to the middle value. Very high or very low numbers will shift it considerably.

- ♦ Is this closer to the middle wage?

  Answer: Yes
- ♦ Why? Can you explain?
- ♦ What reasons can you think of for the middle height and average height being the same?
- ♦ Whose age distorts or skews the average the most?

  Answer: Rita
- ♦ What would be the average age without Rita's? Guess and then check with a calculator.

NAITB, Marr, Anderson & Tout, 1994

Part 5: Averages and ranges in workplace charts

Activity - Averaging production figures - part 1

The purpose of this sheet is to give trainees practice at whole work style tasks as well as practice at calculating averages and plotting charts.

Note - Where possible it is better to use real production charts, relevant to the group, in conjunction with the ideas presented in this section. Such charts can be altered to mirror the activities described below.

Presentation

To each trainee, hand out a copy of the Activity Sheet ***Average production figures - part 1***. Allow trainees time to look at the sheet before discussing its purpose and whether or not such charts are familiar to the group.

The questions below will provide a chance for everyone to understand the format before starting the task.

Ask:

- Have you seen charts anything like this before?
- What are they called?

  Answer: Run charts or line graphs
- Can you see what this one is about?

  Answer: Cylinder Head Production numbers each day for the month of July.

Many workplaces call these run charts - maths teachers call them line graphs.

When the group has had time to familiarise themselves with the graph go on to the actual details. An overhead transparency would help.

Ask:

- Where would the production figure for the 17/7 be plotted?

Ask trainees to finish plotting the production figures using the information from below the chart.

Move around the room to help where necessary.

NAITB, Marr, Anderson & Tout, 1994

When the trainees have finished use the overhead to check the plotted points.

Ask trainees to connect the points if they haven't done so already. Connect the points on the transparency and discuss how this enables changes and trends to be seen more easily.

Ask:

- What is the highest figure shown?
  Answer: 580
- What day is it for?
  Answer: 18/7
- Where did you find the information?
  - is there only one way to see that?
  Answer: Table or chart or both.

In most workplaces you can find figures from the graph/chart or from the table below.

Now to focus on the **monthly average**.

Ask:

- From looking at the graph, what do you think the average daily production for July would be?
- Which day's production will bring down the average?
- Which day's production will make the average better?
- Do the lows and the highs balance each other?

Encourage everyone to make a guess. Write some or all of the guesses on the board before going on.

Ask the group to **calculate** the average. If necessary prompt with the questions below.

Possible questions:

- How do we calculate the average?
- What figure should we divide by?
- How many working days were there for this work team in July?
  Answer: 21
- How do you know?

You may wish to discuss the Clear Entry key on the calculator before the group commences this exercise. See next page.

Discuss whether this group's workplace would have a similar number of days per month. eg.

- Do you work through weekends?
- Do you have plant close down times?

NAITB, Marr, Anderson & Tout, 1994

Allow plenty of time for trainees to calculate the average on the calculator. This can take some time with people unused to calculators.

Check the answer obtained. It should be 340. Compare this with the group's initial guesses.

Ask:

- Was the average above target?
  Answer: Yes
- If you were the employer what would you use as the Target for August, 320 or 340?
- Why would the employer do this?

If workers begin to average above target, many companies would make the higher averape the new target for the following month.

Discuss attitudes of workers and employers to this question before moving on to the next step.

Optional Discussion
The Calculator Clear Entry Key

It may be appropriate or necessary to explain the use of the **CE** or **C** key on a calculator in case trainees press a wrong key for a particular entry. Pressing **CE** or **C** should clear just the last entry and not everything else. It can be thought of as the "oops" key.

For example, if they have already entered production for the first 14 working days and make a mistake on the 15th entry, they can press the **CE**, clear entry, or **C**, Clear, to get rid of the mistake. The total for the first 14 days will still be in the calculator. Ask trainees to check this on their own calculator before starting by entering, for example

10 + 20 + 30 then + 100
Say "oops" - or mistaken entry
- we didn't want the 100
so press C or CE

The last total of 60 should now remain in the display. The 100 should have disappeared.

Warning: the **C** or **CE** button will not work if you have already pressed the = button, so discourage its use until the very end of the calculation.

Activity - Averaging production figures - part 2

Now introduce the idea of using cumulative total as follows.

Ask:

- ♦ Was it easy to calculate the average?
- ♦ Did it take long?
- ♦ What made the task difficult or tedious?
- ♦ Can you think of ways that may make the calculation faster?
- ♦ Has anyone seen any other type of sheet for recording production figures?

Introduce the idea of a progressive addition of Production figures or Cumulative Total.

If no-one suggests cumulative or progressive totals, introduce the idea yourself.

Say:

- ♦ Adding so many figures at one time can be difficult and sometimes it would be easier to add as you go. Each day you add the new figure to the total.

Demonstrate by using the overhead transparency and drawing in another row below the Production row on ***Average production figures - part 1***.

Ask:

- ♦ What was the total production for the **first two** working days of July?

  Answer: 280 + 310 = 590

Write the answer in the new row under 4/7.

- ♦ What about the total for the first three working days?

  Answer: 1080

- ♦ How did you get this answer?

  Some may say they added 280, 310 and 490 together - encourage them to consider that it is just a matter of adding the third figure to the progressive or cumulative total.

Compare the word cumulative with the word accumulate. One way is to imagine the idea of 'accumulating' money if each person in turn gives you a different number of dollars.

Ask:

- ♦ Does anyone know the name given to these progressive totals? Point to 590 and 1080.

  Answer: Cumulative totals.

Write cumulative total (or Cum. Tot.) in the start of the row containing 590 and 1080.

- What was the total production for the first four working days?

  Answer: 1080 + 560 = 1640

- How could we use this to help calculate the average faster?

By having the cumulative total at the end of the month we just need to divide this figure by 21 - instead of adding all the figures at once.

Now distribute to each pair of trainees the Activity Sheet: ***Average production figures - part 2.***

Ask:

- Looking at the sheet, what has been chosen as the Target for August?

Hand out rulers and ask trainees to draw in the Target line.

Direct their attention to the Cumulative total row and ensure they feel confident to fill it in by asking the following:

- What was the production for 22/8?

  Answer: 250

- What would be the Cumulative Total after 22/8?

  Answer: 5170

Ask them to finish the table by filling in the figures and calculating the average.

Care needs to be taken when calculating the average to count up the numbers of days. For example, there were 23 working days in August, not 21 as in July.

Use an overhead transparency of the activity sheet to help check answers and discuss the effectiveness of the new method using the following questions

Ask:

- How did you calculate this?

  Hopefully 7590/23 = 330

- Was this easier and quicker than having to add all the numbers at once?
- Would it be a better method in the workplace situation?

Now ask the group to plot the points on the chart and check them on the overhead.

The following discussion points can be used to give further familiarity with cumulative totals and the meaning of monthly averages.

Possible questions:

- Look at the figures for the first four days.
- Do you think the average production of these four days would be higher than, lower than, or the same as 330?
  Answer: Higher
- How could you calculate the average production for these first four days quickly?
  Answer: 1540 ÷ 4 = 385, using the cumulative total for the 4/8
- What would this mean to the workers for the rest of the month?
  - Would they start to speed up or slow down?

Activity - Control charts

To each pair of trainees hand a copy of the ***Control charts*** activity sheet.

Allow trainees a minute or so to look at the sheet. Then discuss, using an overhead projector transparency of the sheet if possible.

The purpose of this sheet is to give trainees practice at completing a control chart similar to those encountered in the workplace. Control charts are used to keep a check on how production processes change over time.

Possible questions:

- Have you seen charts like this before?
- Who fills them in at your workplace?
- What are they used for?

Point to the date, time, and readings rows.

- Can anyone here explain what goes in the top part of the table?
- Point to the sum and x bar ($\bar{x}$) boxes. Can you tell me what happens in these spaces?
- Point to the R (range) box. What goes in here? How do you work that out?

Sum is another word for the total when the five readings are added together, $\bar{x}$, x bar, is just a symbol for average.

NAITB, Marr, Anderson & Tout, 1994

This particular chart is measuring the 'gloss' or 'shine' of completed bumper bars.

Each morning and each afternoon, five finished bumper bars are taken off the production line and measured with a 'gloss meter'. These readings are put in the table and the average is plotted onto the control chart.

Get trainees to calculate together the sum and then the average and range for the 3rd of July in the afternoon (pm). Give enough time for these to be worked out using calculators.

Answers: $Sum = 104.2,\ \bar{x} = 20.8,\ R = 2.2$

Note: Calculators will show 20.84 for $\bar{x}$ but explain that 20.8 is accurate enough. In other words, the numbers are rounded off.

Now ask trainees to plot this point on the control chart. Use the overhead transparency to check.

Ask:

- Is this point between the control limits?
- Does this point show that the process is OK?
- Would we need to take any action?
- When would we need to take action?

The first point is within control limits, so no action would be needed yet.

Now ask trainees to calculate the sum and average for 4/7 am and plot the point.

Check their answers and again decide if the point is OK - between the control limits.

Now distribute a labelled envelope containing the ***Control chart - cards*** to each pair of trainees.

Ask them to open the envelopes, take out the cards and place them face down on the table between them.

Tell them the information they need to fill in the rest of the readings are on these cards.

Explain the activity as follows, or if language presents a problem act out the process with one person from the group.

Say:

- For this activity you will take turns.
- One person in each pair should pick up a card but not show it to the other person.
- The person with the card has to read out the date, time, and the readings so that the other can write them down on the sheet.
- Listen to the date and time and make sure you put the readings in the correct column.
- When this is done put that card down and change roles.
- Both write on the same sheet.
- Keep going until all cards have been read.
- When all the information has been recorded turn the cards up and together check to see if you agree that the readings have been written correctly in the table.

The information on the cards is written in words to give practice at reading, hearing and translating numbers. It may also simulate possible workplace practice where one person calls out the figures for someone else to write down.

Once the pairs have reached agreement use the overhead transparency of the ***Control charts*** sheet, to check what they have recorded.

Now ask the pairs to work together taking turns to calculate the sum, average, and range for each column, and to plot the averages on the control chart. Again use the overhead transparency to help check the results and to assist with a discussion of the implications.

Ask:

- Were all averages within the control limits?
- Do you notice anything particular about the chart?
- What is it?
- Would we need to take action?

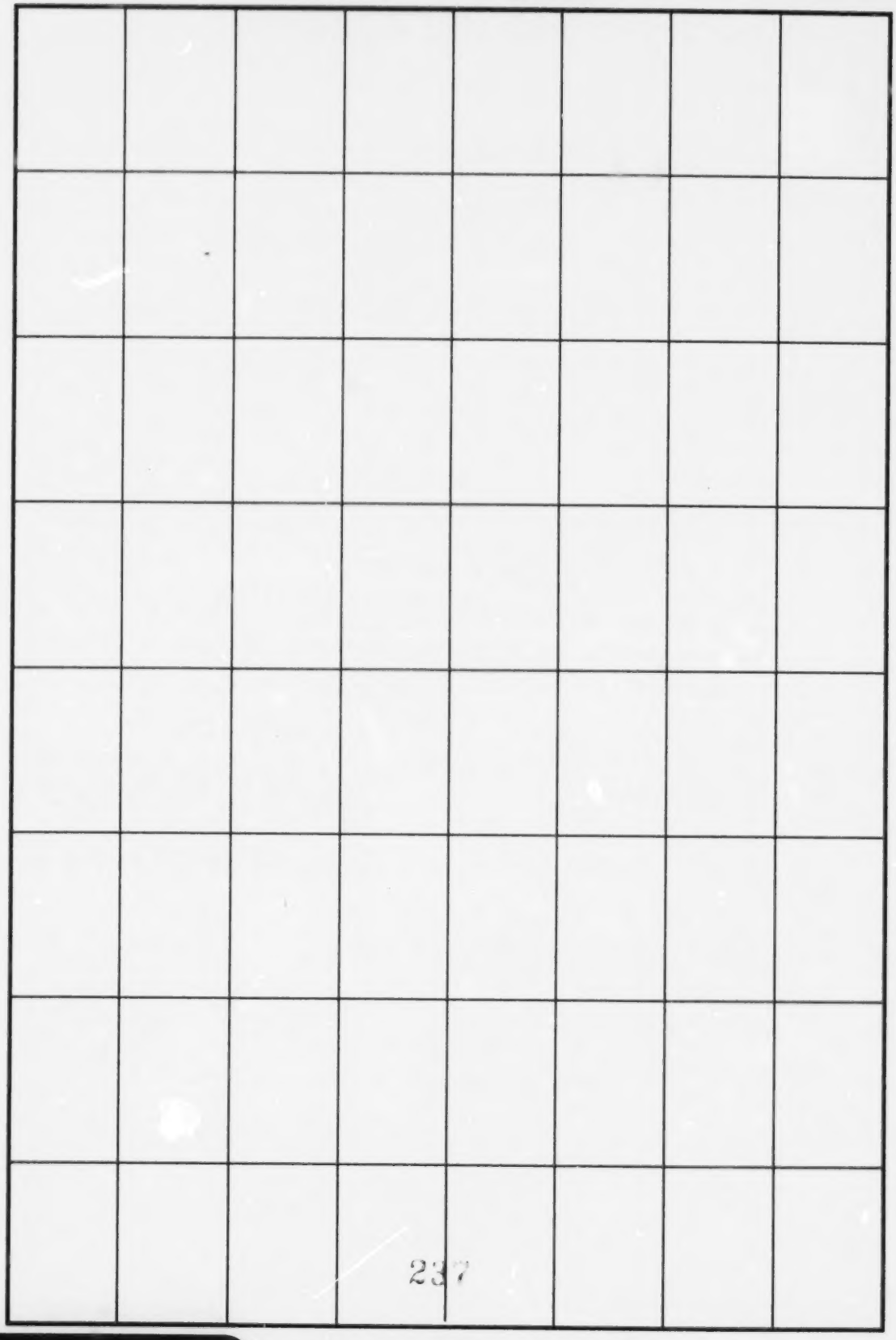
Although all averages fell within control limits, the last seven points are in a downward run. This is one of the classic warning signs and action would be needed.

NAITB, Marr, Anderson & Tout, 1994

Your notes and ideas

NAITB, Marr, Anderson & Tout, 1994

The mean grid



Using averages

1. Cylinder heads come off the production line at an **average** of **44 per hour**. How many would you expect to have made:
   - in three days (with one eight hour shift per day)?

   - in a month of 21 working days?

2. A work group assembles on **average 53** car heater units **per hour**.
   - How many would they make in a day (one eight hour shift)?

   - How many would they probably make in a 40 hour week (5 shifts)?

   - How many would they have made in May this year?

3. Maria's team use an **average** of **10** brand label disks **per hour**.
   - How many would they use in a day (one eight hour shift)?

   - How many would they need for a week (5 shifts)?

4. A car using leaded petrol emits an **average** of **3 grams** of lead into the air for every 100 km.
   - The car travels the approximately 900 km from Melbourne to Sydney. How much lead would be given off?

Average wages

Button Car Factory Pay Slip	Button Car Factory Pay Slip
Production worker **Level 1**	Production worker **Level 1**
Weekly wage:	**Weekly wage:**
$430.00	**$430.00**
Button Car Factory Pay Slip	Button Car Factory Pay Slip
Production worker **Level 1**	Production worker **Level 1**
Weekly wage:	**Weekly wage:**
$430.00	**$430.00**
Button Car Factory Pay Slip	Button Car Factory Pay Slip
Production worker **Level 2**	Production worker **Level 2**
Weekly wage:	**Weekly wage:**
$440.00	**$440.00**
Button Car Factory Pay Slip	Button Car Factory Pay Slip
Production worker **Level 2**	Production worker **Level 3**
Weekly wage:	**Weekly wage:**
$440.00	**$470.00**
Button Car Factory Pay Slip	Button Car Factory Pay Slip
Production worker **Level 3**	**Production manager**
Weekly wage:	**Weekly wage:**
$470.00	**$1500.00**

Averages - data sheet

Mike

- 200cm
- 25 years old
- Earns $430 per week

Rita

- 180cm
- 52 years old
- Earns $470 per week

Phuong

- 152cm
- 30 years old
- Earns $440 per week

Con

- 168cm
- 28 years old
- Earns $430 per week

Ali

- 175cm
- 40 years old
- Earns $1500 per week

About averages part 1

❶ Use the ***Averages - data sheet*** to write the numbers down in order:

heights: ***152 cm*** _____

shortest *tallest*

ages: _____

youngest *oldest*

wages: _____

lowest *highest*

❷ Answer these questions. Tick the best answer.

TRY THEM WITHOUT CALCULATING

The average height could be approximately

160 cm
175 cm
200 cm

The average age might be around

25 years
30 years
35 years

The average wage is probably about

$435
$440
$650

per week.

❸ Now work out the answers with a calculator.

Average height:

Average age:

Average wage:

About averages part 2

❶ Use words from the box to fill the spaces.

above	below	about

Rita is _____ average height.

Con's wage is _____ average.

Ali is _____ average height.

Phuong is _____ average age.

❷ Make up 2 sentences of your own.

Mike _____

Rita _____

❸ Put the correct names in the spaces.

_____ height is in the middle.

_____ is the middle age.

_____ gets the middle wage.

❹ Use these words to fill in the spaces.

higher than	increased	lower than
decreased	the same as	

The average wage is _____ the middle wage.

The middle height is _____ the average.

The middle age is _____ the average age.

Without **Ali** the average wage would be _____.

Without **Phuong** the average height would be _____.

Without **Rita** the average age would be 242.

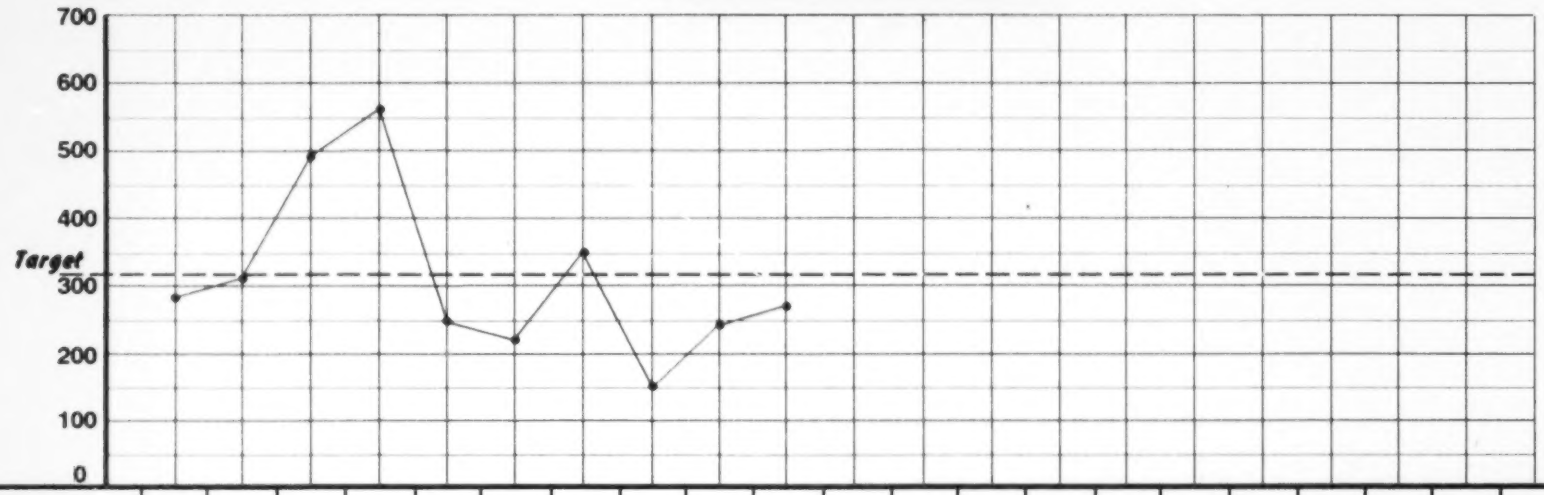
Average production figures

Part 1

MONTH: July

CYLINDER HEADS DAILY SHIFT OUTPUT

TARGET: 320



DATE	3/7	4/7	5/7	6/7	7/7	10/7	11/7	12/7	13/7	14/7	17/7	18/7	19/7	20/7	21/7	24/7	25/7	26/7	27/7	28/7	31/7	Monthly average
# Parts made	280	310	490	560	250	220	350	150	240	270	520	580	420	470	340	320	280	320	200	220	350	

243

244

Monthly average

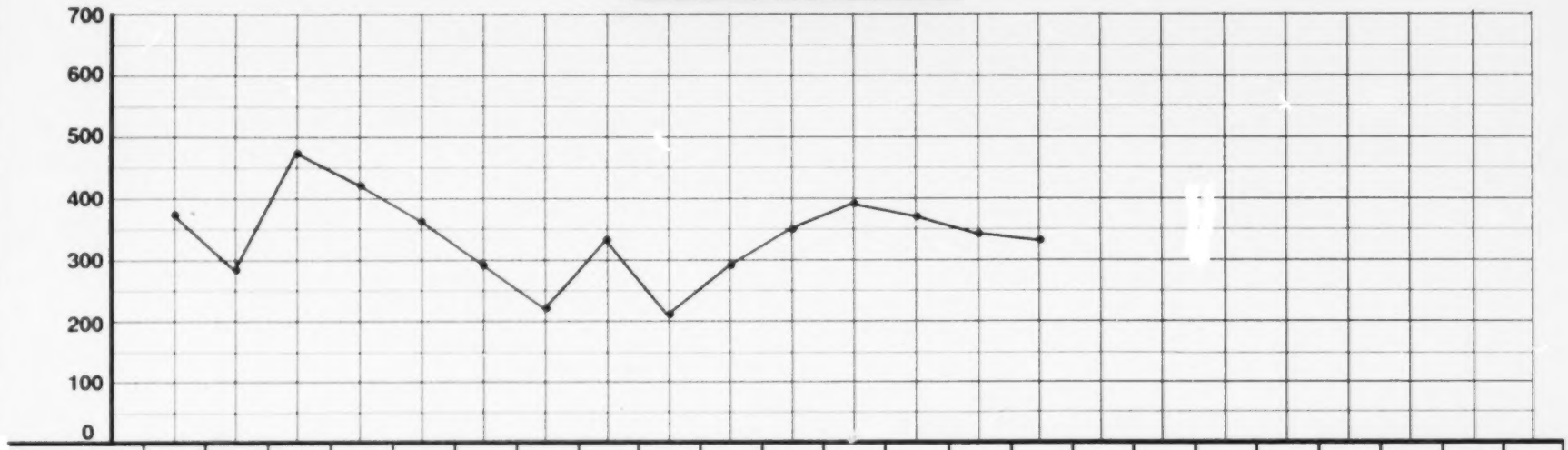
Average production figures

Part 2

MONTH: August

CYLINDER HEADS DAILY SHIFT OUTPUT

TARGET: 340



DATE	1/8	2/8	3/8	4/8	7/8	8/8	9/8	10/8	11/8	14/8	15/8	16/8	17/8	18/8	21/8	22/8	23/8	24/8	25/8	28/8	29/8	30/8	31/8	Month ave.
# Parts made	370	280	470	420	360	290	220	330	210	290	350	390	370	340	330									
Cum. total	370	650	1120	1540	1900	2190	2310	2640	2850	3140	3490	3880	4250	4590	4920									

Production figures for the last 8 days were:

22/8: two hundred and fifty
23/8: one hundred and seventy
24/8: three hundred and eighty
25/8: four hundred and forty
28/8: four hundred and twenty
29/8: two hundred and eighty
30/8: three hundred and seventy
31/8: three hundred and sixty

Monthly average

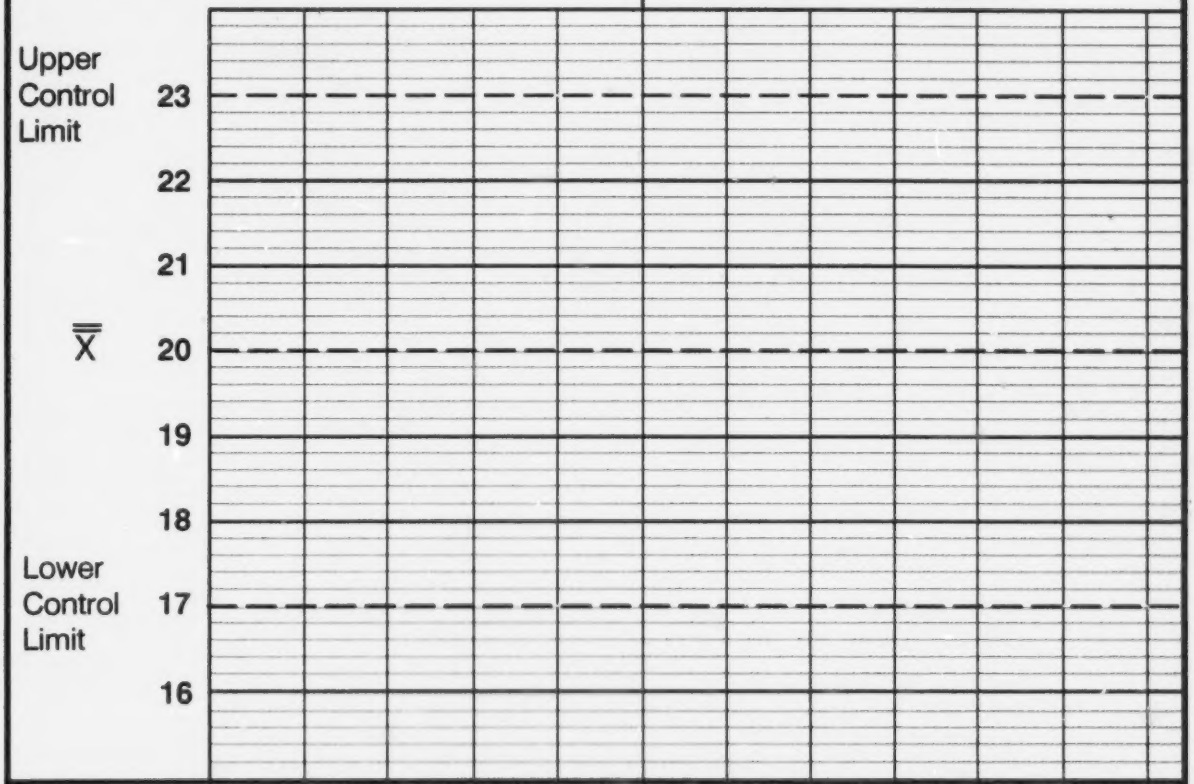
Control charts

Button Motor Co.
Control Chart

Plant: PLASTICS

Part name: Bumpers

Characteristic: GLOSS



DATE		3/7	3/7	4/7	4/7	5/7	5/7	6/7	6/7	7/7	7/7	
TIME		am	pm	am	pm	am	pm	am	pm	am	pm	
READINGS	1	21.5	20.8	22.1								
	2	20.2	19.6	22.7								
	3	23.4	21.4	21.5								
	4	19.8	21.8	22.6								
	5	22.1	20.6	22.0								
SUM		107.0										
$\overline{X}$		21.4										
R		4.6										

Control charts cards

Date: *4/7* **Time:** *3.00 pm*
Readings:
1. *Twenty one point two*
2. *22.4*
3. *twenty two point eight*
4. *twenty one and a half*
5. *21.9*

Date: *5/7* **Time:** *10.10 am*
Readings:
1. *17.9*
2. *twenty two and a half*
3. *twenty one point eight*
4. *23.2*
5. *twenty point one*

Date: *5/7* **Time:** *3.30 pm*
Readings:
1. *Twenty one exactly*
2. *twenty two point nine*
3. *19.8*
4. *twenty point two*
5. *20.3*

Date: *6/7* **Time:** *10.30 am*
Readings:
1. *Twenty point two*
2. *nineteen and a half*
3. *twenty one point two*
4. *18.8*
5. *19.4*

Date: *6/7* **Time:** *3.00 pm*
Readings:
1. *20.4*
2. *eighteen point two*
3. *nineteen point six*
4. *seventeen point nine*
5. *18.9*

Date: *7/7* **Time:** *10.40 am*
Readings:
1. *18.3*
2. *seventeen point nine*
3. *nineteen point one*
4. *seventeen point seven*
5. *eighteen point seven*

Date: *7/7* **Time:** *3.20 pm*
Readings:
1. *eighteen point four*
2. *17.6*
3. *eighteen point zero*
4. *16.8*
5. *seventeen point nine*

Using averages

1. • Three days:
   44 x 8 x 3 = 1056 cylinder heads
   • Month (21 work days):
   44 x 8 x 21 = 7392 cylinder heads
2. • A day:
   53 x 8 = 424 heater units
   • 40 hour week:
   53 x 40 = 2120 heater units
   (or 424 x 5 = 2120)
   • May:
   424 x no. of working days
3. • Day:
   10 x 8 = 80 brand label disks
   • Week:
   80 x 5 = 400 disks
4. 3 gm x 9 = 27 gm lead

PRACTICE SHEET

About averages part 1

❶ Use the **Averages - data sheet** to write the numbers down in order:

heights: 152 cm (shortest) 168 cm 175 cm 180 cm 200 cm (tallest)

ages: 25 (youngest) 28 30 40 52 cm (oldest)

wages: $630 (lowest) $630 $900 $970 $1500 (highest)

❷ Answer these questions. Tick the best answer.

TRY THEM WITHOUT CALCULATING

The average height could be approximately [160 cm] [175 cm] [200 cm]

The average age might be around [25 years] [30 years] [35 years]

The average wage is probably about [$435] [$440] [$850] per week.

❸ Now work out the answers with a calculator.

Average height: $\frac{875}{5} = 175$ cm

Average age: $\frac{175}{5} = 35$ years

Average wage: $\frac{$3270}{5} = 654

PRACTICE SHEET

About averages part 2

❶ Use words from the box to fill the spaces.

above	below	about

Rita is **above** average height.

Con's wage is **below** average.

Ali is **about** average height.

Phuong is **below** average age.

❷ Make up 2 sentences of your own.

Mike _____

Rita _____

❸ Put the correct names in the spaces.

Ali's height is in the middle.

Phuong's is the middle age.

Phuong's gets the middle wage.

❹ Use these words to fill in the spaces.

higher than	increased	lower than
decreased	the same as	

The average wage is **higher than** the middle wage.

The middle height is **the same as** the average.

The middle age is **lower than** the average age.

Without **Ali** the average wage would be **decreased**.

Without **Phuong** the average height would be **increased**.

Without **Rita** the average age would be **decreased**.

BEST COPY AVAILABLE

ACTIVITY SHEET p 33

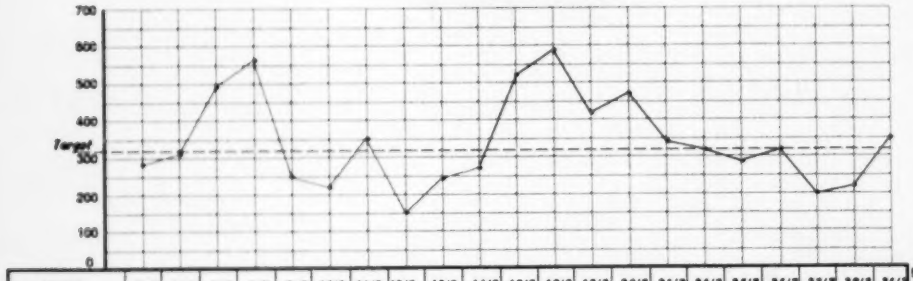
Average production figures

Part 1

MONTH: July

CYLINDER HEADS DAILY SHIFT OUTPUT

TARGET: 320



DATE	3/7	4/7	5/7	6/7	7/7	10/7	11/7	12/7	13/7	14/7	17/7	18/7	19/7	20/7	21/7	24/7	25/7	26/7	27/7	28/7	31/7	Monthly average
# Parts made	380	310	490	560	250	220	350	150	240	270	520	580	620	470	360	320	280	320	200	220	350	340

Monthly average

What averages mean — NAITB, Marr, Anderson, & Tout, 1994

ACTIVITY SHEET p 34

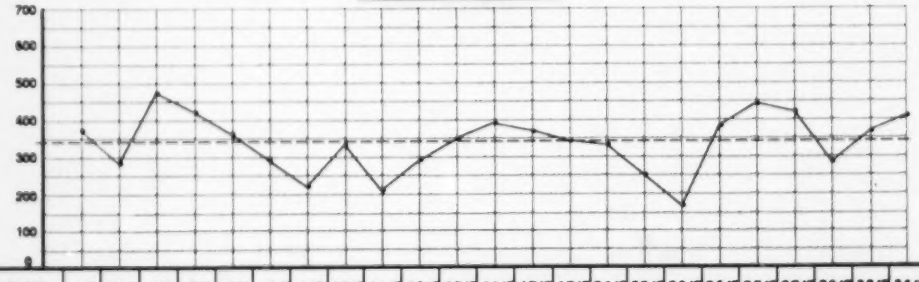
Average production figures

Part 2

MONTH: August

CYLINDER HEADS DAILY SHIFT OUTPUT

TARGET: 340



DATE	1/8	2/8	3/8	4/8	7/8	8/8	9/8	10/8	11/8	14/8	15/8	16/8	17/8	18/8	21/8	22/8	23/8	24/8	25/8	28/8	29/8	30/8	31/8	Month ave
# Parts made	370	280	470	620	360	290	220	330	210	290	350	390	370	360	330	250	170	380	440	620	280	370	360	336
Cum. total	370	650	1120	1740	2100	2390	2610	2940	3150	3440	3790	4180	4550	4910	5240	5490	5660	6040	6480	7100	7380	7750	8110	

Production figures for the last 8 days were:

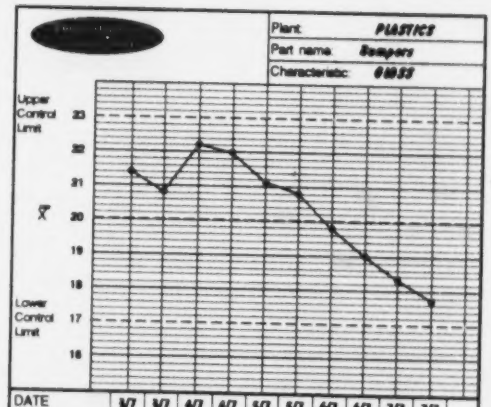
22/8: two hundred and fifty
23/8: one hundred and seventy
24/8: three hundred and eighty
25/8: four hundred and forty
28/8: four hundred and twenty
29/8: two hundred and eighty
30/8: three hundred and seventy
31/8: three hundred and sixty

Monthly average

What averages mean — NAITB, Marr, Anderson, & Tout, 1994

ACTIVITY SHEET

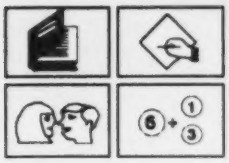
Control charts



DATE		3/7	3/7	4/7	4/7	5/7	5/7	6/7	6/7	7/7	7/7
TIME		am	pm	am	pm	am	pm	am	pm	am	pm
READINGS	1	21.5	20.8	22.1	21.2	17.9	21.0	20.2	20.4	18.3	18.4
	2	20.2	19.6	22.7	22.4	22.5	22.9	19.5	18.2	17.9	17.6
	3	23.4	21.4	21.5	22.8	21.8	19.8	21.2	19.6	19.1	18.0
	4	19.8	21.8	22.6	21.5	23.2	20.2	18.8	17.9	17.7	16.8
	5	22.1	20.6	22.0	21.9	20.1	20.3	19.4	18.9	18.7	17.9
SUM		107.0	104.2	110.9	109.8	105.5	104.2	99.1	95.0	91.7	88.7
$\bar{X}$		21.4	20.8	22.2	22.0	21.1	20.8	19.8	19.0	18.3	17.7
R		4.6	2.8	1.2	1.6	5.3	3.1	2.4	2.5	1.4	1.6

BEST COPY AVAILABLE

Where else to go



NATIONAL AUTOMOTIVE
LANGUAGE & LITERACY
COORDINATION UNIT

Where else to go

Purpose

This section includes information about where to go for further information about teaching basic mathematics. There are contacts for chasing up other resources, and listings of other suitable resources and their availability.

As well there are detailed cross-references to worksheets from two other key adult maths books. These can be used as supporting material for supplementary work or further practice.

NAITB, Marr, Anderson & Tout, 1994

Where can I go for more advice?

Adult Basic Education Resource & Information Service (ARIS)

National Languages and Literacy Institute of Australia (NLLIA)
Victoria University of Technology Building
Level 9, 300 Flinders Street
Melbourne VIC 3000

Contact: Dave Tout. Phone: (03) 614 0255

Adult Literacy Information Office (ALIO)

199 Regent Street
Redfern
NSW 2016

Contact: Phone: (02) 699 8955

ARIS and ALIO have collections of reference and teaching materials suitable for teaching adults, and can refer people to other appropriate organisations or individuals. They also sell and distribute Victorian and NSW produced adult literacy and numeracy resources.

Adult Numeracy Centre

Northern Metropolitan College of TAFE
St Georges Road
Preston VIC 3072

Contact: Beth Marr. Phone: (03) 270 1512 or 270 0255

Other suitable resources

- ***Strength in Numbers - A resource book for teaching adult numeracy***, Goddard, R., Marr, B. & Martin, J., Division of Further Education, Victoria, 1991
  Strength in Numbers concentrates on early numeracy skills. It assumes very little knowledge of formal mathematics by teachers or trainers and so is ideal for use by people inexperienced in teaching mathematics. It also contains many new ideas for the experienced teacher. The worksheets and activities have been especially designed for adults and the language used is suitable for students with low level English literacy and language skills.

Background, strategies and rationale are given for each of the six sections. These are: Getting Started; Addition and Subtraction; Multiplication and Division; Money and Metrics; and Fractions and Percentages. The materials and methods used in this book encourage students to learn through interaction and cooperation, involving the use of discussion, practical activities and hands-on materials.

It is available from ARIS (see above for address) for $30.00 plus postage and handling.

♦ ***Mathematics: A New Beginning***, Marr. B., & Helme, S. (ed.s), State Training Board of Victoria, Victoria, 1987.
Mathematics: A New Beginning details and explains appropriate and successful teaching strategies and approaches for teaching maths to adults and supports these with a wide range of student worksheets and activities. The approach taken encourages the use of hands-on materials, and promotes interaction and cooperation in maths learning with the aim of making maths relevant and enjoyable.

The areas it covers include: Exploring Numbers; Fractions; Metrics and Measurement; Estimation and Calculators; Problem Solving; and Ratio and Percentages. It is at a level higher than that covered in ***Strength in Numbers***.

It is available from Northern Metropolitan College of TAFE (see above for address) for $33.00 plus postage and handling.

♦ Another resource which is available free (although there is a postage and handling charge) from ARIS is:
An Annotated Bibliography of Basic Maths and Numeracy Resources for Adults, *Marr, B., Adult, Community and Further Education Board, Victoria, 1992.*
This bibliography details a range of suitable maths resources for teaching adults.

Supplementary worksheets

The following pages list references to other resources under a number of topics. The references are to other worksheets or activities suitable for use as reinforcement of skills, for further practice or for support for trainees having difficulty with particular topics.

How to read the references

The abbreviations used are: **MANB** is **Mathematics: A New Beginning**
SIN is **Strength in Numbers**

eg.

*The book: **Strength in Numbers*** → **SIN EN 17 - 22** ← *The page numbers*

255

*The section called: **Exploring Numbers***

NAITB, Marr, Anderson & Tout, 1994

Whole Number Skills Practice

General Exploratory Work

- to help assess problems students are having.
- to give them confidence about problem solving and their existing arithmetic skills.

Number Patterns - Activity One **SIN EN 17-22**
Some pattern activities to practise a variety of number skills such as adding.

Number Patterns **MANB GS 23-25**
More advanced pattern activities to check on the four operations, +, -, x, ÷, and understanding of fractions and decimals.

Understanding Our Number System **SIN EN 43-46**
MANB EN 3-12
Assists students to understand place value - how numbers fit together.

Addition and Subtraction

Learning Addition Facts **SIN AS 7-12**
A variety of strategies to assist students to memorise number facts such as 9+1=10, 7+5=12 etc. These, like multiplication tables, are important if calculating is ever going to be efficient.

Building Addition Skills **SIN AS 13-22**
An explanation using hands on materials and practice worksheets, to develop understanding of how the formal method of addition with carrying works.

Concept of Subtraction **SIN AS 23-26**
Four activities which enable the exploration of the idea of subtraction. These also concentrate on the language used for subtraction.

Building Subtraction Skills **SIN AS 27-36**
This shows how the formal methods of subtraction work, and explanations are given for the two commonest methods. Again the approach taken uses hands-on materials and activities.

Subtraction in Stages **SIN AS 37**
Explanation and practice examples of a more common sense approach to subtraction - without getting tangled in borrowing and paying back - an empowering technique.

NAITB, Marr, Anderson & Tout, 1994

Addition and Subtraction - Word Problems **SIN AS 41-50**
Plenty of practice examples for addition and subtraction in real life adult contexts - money, dates, times and measurements. Most involve making decisions about which operation to use as well as the calculations.

Multiplication and division

Multiplication and Division - Introductory Notes **SIN MD 1-4**
Discussion for teachers on issues concerning teaching these skills, including how to deal with remainders.

Concept of Multiplication **SIN MD 9-13**
A session with worksheets exploring the meaning of multiplication.

Building Multiplication Skills **SIN MD 15-21**
An exploration, using hands on materials and practice worksheets, to develop understanding of how the formal method of multiplication works.

Doubling and Some Shortcuts in Multiplication **SIN MD 23-30**
A look at more "in the head" methods of multiplication typically used by adults.

Learning Multiplication Tables **SIN MD 31-39**
A variety of strategies and games to assist students memorise multiplication tables.

Concept of Division **SIN MD 41-43**
A session using hands on materials and worksheet practice to examine the "sharing" idea of division and the notion of remainders.

Building Division Skills **SIN MD 45-49**
Uses hands on materials to develop the formal method of division.

Multiplication and Division Word Problems **SIN MD 55-63**
A selection of practice examples for multiplication and division in a variety of adult contexts. Most involve making decisions about the appropriate operation to use. These could also be used to practise calculator skills.

Multiplication and Division by Powers of Ten **MANB EN 13-18**
A session with accompanying worksheets to examine and practise the skill of adding or removing zeroes when multiplying or dividing by 10, 100, 1000, etc.

Calculators

Guess the Number - a Game **SIN EN 41**
- confidence Builder with calculator
- develops place value
- practice in verbalising numbers
- use of memory (extension)

(could be done before the session: ***Where Do We Start?***, in **Numeracy on the Line**)

Calculator and Money **SIN MM 27-39**
- a session to go through steps of using a calculator.
- practice on work sheets

(Further practice for ***Where Do We Start?***)

Calculator Extension Work

Large Numbers on the Calculator **MANB EC 29-32**
Explanation and worksheet on how to use te calculator when there are too many digits to fit on the display.

Using the Calculator's Memory **MANB EC 33-37**
More practice at use of memory extending to more complex calculations - some challenges for the more experienced.

Some Problem Solving Using Calculators
The Gym Problem **MANB EC 24**
Ancestor Problem **MANB EC 43**

Some Extension Activities for small groups
Two excellent games for more advanced class members that encourage and support the meaning of decimals.
Target 100 **MANB EN 46**
Decimal Dilemma **MANB EN 47**

NAITB, Marr, Anderson & Tout, 1994

Decimals

Introduction to decimals **MANB EN23 to 34**
Support material to help understand decimals. Uses grids, fractions, rulers and calculators.

Rounding decimals **MANB EN35 - 40**
Explanations and worksheets on the rounding of decimal numbers.

Working with Decimals **MANB EN41 - 50**
Explanations, activities and worksheets on working with decimals. Some of the activities would also be good for extension work with calculators.

Percentages

The Meaning of Percent **SIN FP33 - 35**
Explanation and worksheet on the meaning of percent.

Percentage Bars **SIN FP37 - 38**
Explanation about the drawing of percentages on bars.

Using Percentages **SIN FP39 - 45**
Four worksheets and explanations about straightforward percentages. Pie charts, writing numbers as percentages, finding percentages of an amount, and discounts.

Percentage Extensions

Introduction to Percentages **MANB FA3 - 9**
Fractions to decimals to percentages and vice versa.

Finding Percentages **MANB FA11 - 20**
Practice examples of finding percentages of quantities.

NAITB, Marr, Anderson & Tout, 1994